

3.8.7 CULTURAL AND PALEONTOLOGICAL RESOURCES

Prehistoric Resources. Three surface examination surveys have been conducted at RFETS resulting in complete coverage of the undisturbed portions of the facility (RF EG&G 1991a:3-2). No prehistoric sites were identified. However, two sites with rock alignments and four isolated cairns were recorded and are most likely prehistoric sites. The two sites have not been evaluated to determine their NRHP eligibility, and these sites are considered potentially NRHP eligible pending additional work. The four isolated features are not considered NRHP eligible. DOE is currently preparing a cultural resources management plan for RFETS to ensure compliance with Sections 106 and 110 of the NHPA.

Historic Resources. Thirty-five historic sites have been identified at RFETS. All undisturbed portions of RFETS have been intensively surveyed. Most of the historic resources in the area are archaeological sites or standing structures associated with ranching or transportation routes. Historic site types in the vicinity include trails, railroad grades, homesteads, cattle camps, line shacks, ranch complexes, irrigation ditches, stock ponds, and windmills. Historic sites recorded at RFETS include a railroad grade, stock ponds and tanks, irrigation ditches, corrals, a fence, a dump, a spring house, and homesteads. None of the historic sites or features have been recommended as eligible for the NRHP. There are 123 buildings at RFETS associated with the Cold War mission. Of these, 64 are considered potentially eligible for listing on the NRHP as contributing elements to the Rocky Flats Plant Historic District (RF DOE 1995a:26).

Native American Resources. Several Native American groups, including the Plains Apache, Comanche, Ute, Arapaho, and Cheyenne, historically occupied or traversed the foothills around RFETS. Tribal locations have been estimated for the Protohistoric and Historic periods. The Plains Apache occupied the region east of the Rockies prior to 1700. By 1750, the Ute and Comanche were in the area. The Ute moved back into the mountains and the Comanche were located on the Plains by 1820. From 1820 through 1870, the Cheyenne and Arapaho groups were using the area. All of these groups were highly mobile hunters and gatherers whose primary subsistence was based on bison procurement and seasonal plant gathering.

Important sites, such as burial or vision quest locations, may be of concern to Native American groups. Several unidentified rock features and alignments that have been recorded on RFETS may also be of concern to Native American groups. Consultation with the Comanche, Cheyenne, Arapaho, Southern Ute, Mountain Ute, and Apache tribes has been initiated by DOE. Important Native American resources may be identified through consultation with potentially affected groups.

Paleontological Resources. Surface geology at RFETS includes Rocky Flats alluvium and Arapahoe sandstone. The Arapahoe sandstone consists of claystone, silty claystones, and sandstones, and is not fossiliferous. Arapahoe sandstone outcrops occur along the edges of Walnut and Woman Creeks. The rest of RFETS is covered by Rocky Flats alluvium, which consists of gravely clays, sands, and gravels. No paleontological materials have been recovered from the RFETS alluvium, and it is considered nonfossiliferous.

3.8.8 SOCIOECONOMICS

Socioeconomic characteristics described for RFETS include employment and regional economy, population and housing, community services, and local transportation. Statistics for employment and regional economy are presented for the REA that encompasses 49 counties around RFETS located in Colorado, Nebraska, and Kansas (Table L.1-1). Statistics for the remaining socioeconomic characteristics are presented for the ROI, a five-county area (located in Colorado) in which 90.6 percent of all RFETS employees reside: Adams County (20 percent), Arapahoe County (3.6 percent), Boulder County (25.6 percent), Denver County (6.2 percent), and Jefferson County (35.2 percent) (Table L.1-8). In 1995, RFETS employed 4,435 persons.

Regional Economy Characteristics. Selected employment and regional economy statistics for the RFETS REA are summarized in Figure 3.8.8-1. Between 1980 and 1990, the civilian labor force in the REA increased 39.9 percent to the 1990 level of 1,868,628. The 1994 unemployment in the REA was 4.1 percent, which parallels the unemployment for Colorado. The unemployment for Kansas is about 1 percent higher than that of the REA and Nebraska is about 1 percent lower than the REA unemployment rate. The region's per capita income of \$21,958 in 1993 was approximately 2 percent greater than Colorado's per capita income of \$21,498. Kansas' per capita income (\$19,849) was 9.6 percent lower than the region's, and Nebraska's per capita income (\$19,673) was 10.4 percent lower.

As shown in Figure 3.8.8-1, the composition of the REA economy was similar to that of the statewide economy of Colorado. During 1993, the services sector constituted over 31 percent of the region's total employment followed by retail trade (about 17 percent) and manufacturing (about 9 percent). For Colorado, the service sector accounted for slightly over 30 percent of the total employment, while retail trade accounted for 17 percent and manufacturing, 8 percent. Kansas and Nebraska parallel each other, with the service sector representing 25 and 26 percent of total employment, retail trade representing 17 percent for both States, and manufacturing representing 12 and 10 percent, respectively.

Population and Housing. In 1994, the ROI population totaled 1,957,797. From 1980 to 1994, the ROI population grew by 22.9 percent, compared to 26.5 percent for Colorado. Within the ROI, Arapahoe County experienced the greatest population increase, 51.2 percent, while Denver County's population increased by only 0.2 percent. Population and housing trends are summarized in Figure 3.8.8-2.

The increase in number of housing units in the ROI between 1980 and 1990, 22.5 percent, was about 1 percent less than the increase in Colorado housing units. The total number of housing units in the ROI for 1990 was 788,480. The 1990 ROI homeowner and renter vacancy rates, 3.2 and 11.7 percent, respectively, were similar to those in Colorado.

Community Services. Education, public safety, and health care characteristics were used to assess the level of community service in the RFETS ROI. Figure 3.8.8-3 presents school district characteristics for the RFETS ROI. Figure 3.8.8-4 summarizes public safety and health care services.

Education. In 1994, 18 school districts provided public education services and facilities in the RFETS ROI. As seen in Figure 3.8.8-3, these school districts operated at between 67.5-percent (Denver County School District) and 102.5-percent (Byers School District) capacity. The average student-to-teacher ratio for the RFETS ROI in 1994 was 19:1. The Jefferson County School District had the highest ratio at 23.7:1.

Public Safety. City, county, and State law enforcement agencies provided police protection to the residents of the ROI. In 1994, a total of 3,811 sworn police officers were serving the five-county ROI. The city of Denver employed the largest number of officers (1,378) and had the highest officer-to-population ratio (2.8 sworn officers per 1,000 persons). The average ROI officer-to-population ratio was 2.0 officers per 1,000 persons. Figure 3.8.8-4 compares police force strengths across the ROI.

Fire protection services in the RFETS ROI were provided by 5,408 paid and volunteer firefighters in 1995. The fire district with the highest firefighter-to-population ratio was Adams County, with 9.5 firefighters per 1,000 persons, as indicated in Figure 3.8.8–4. Adams County also employed the greatest number of firefighters (1,396). The average firefighter-to-population ratio in the ROI was 2.7 firefighters per 1,000 persons.

Health Care. There were 19 hospitals serving the five-county ROI in 1994. Over 64 percent of the hospital bed capacity was located in 9 hospitals in the city of Denver. Figure 3.8.8–4 displays the hospital bed-to-population ratios for the RFETS ROI counties. During 1994, all 19 hospitals operated at below capacity, with bed occupancy rates ranging from 22.4 percent in Adams County to 60.2 percent in Denver County.

There were 5,017 physicians in the ROI during 1994, with the majority (2,649) practicing in Denver County. Figure 3.8.8–4 shows that the physician-to-population ratio ranged from 1.2 physicians per 1,000 persons in Jefferson County to 5.4 physicians per 1,000 persons in Denver County. The average ROI physician-to-population ratio was 2.6 physicians per 1,000 persons.

Local Transportation. Vehicular access to RFETS is provided by Colorado State Route 93 to the west and Jefferson County Road 17 (Indiana Street) to the east (see Figure 2.2.7–1 and Figure 2.2.7–2).

Road improvements for segments providing access to RFETS include bridge replacement and reconstruction along Colorado State Route 93 prior to the year 2000. There are no current road improvements that would affect access to RFETS. There is no public transportation to RFETS (RFETS 1995a:4).

Major railroads in the ROI include the Denver and Rio Grande Western Railroad; the Burlington Northern and Santa Fe Railroad; and the Union Pacific Railroad. A single-track spur from the Denver and Rio Grande Western Railroad mainline accesses RFETS from the west. No navigable waterways within the ROI are capable of accommodating waterborne transportation of material shipments to RFETS (DOE 1993j:4-190,4-191). The Denver International Airport, which began operations in 1995, provides passenger and cargo service in the ROI on national and international carriers.

3.8.9 PUBLIC AND OCCUPATIONAL HEALTH AND SAFETY

Radiation Environment. Major sources and levels of background radiation exposure to individuals in the vicinity of RFETS are shown in Table 3.8.9-1. Annual background radiation doses to individuals are expected to remain constant over time. The total dose to the population changes as the population size changes. Background radiation doses are unrelated to RFETS operations.

Table 3.8.9-1. Sources of Radiation Exposure to Individuals in the Vicinity, Unrelated to Rocky Flats Environmental Technology Site Operation

Source	Effective Dose Equivalent (mrem/yr)
Natural Background Radiation^a	
Cosmic and cosmogenic radiation	51
External terrestrial radiation	63
Internal terrestrial radiation	39
Radon in homes (inhaled)	200
Other Background Radiation^b	
Diagnostic x rays and nuclear medicine	53
Weapons test fallout	<1
Air travel	1
Consumer and industrial products	10
Total	418

^a RFETS 1994a.

^b NCRP 1987a.

Note: Value for radon is an average for the United States.

Releases of radionuclides to the environment from RFETS operations provide another source of radiation exposure to individuals in the vicinity of RFETS. Types and quantities of radionuclides released from RFETS operations in 1993 are listed in the *Site Environmental Report for 1993* (RFP-ENV-93). The doses to the public resulting from these releases are presented in Table 3.8.9-2. These doses fall within radiological limits (DOE Order 5400.5) and are small in comparison to background radiation. The doses given in the 1993 report were assumed to be representative of the reference environment (No Action) doses from RFETS operations in the year 2005 (Section 4.2.7.9).

Based on a risk estimator of 500 cancer deaths per 1 million person-rem to the public (Section M.2.1.2), the fatal cancer risk to the maximally exposed member of the public due to radiological releases and resulting impacts from RFETS operations in 1993 is estimated to be 2.4×10^{-7} . That is, the estimated probability of this person dying of cancer at some point in the future from radiation exposure associated with 1 year of RFETS operations is about 2 in 10 million. (Note that it takes several to many years from the time of exposure to radiation for a cancer to manifest itself.)

Based on the same risk estimator, 5.0×10^{-5} excess fatal cancers are projected in the population living within 80 km (50 mi) of RFETS from normal operations in 1993. To place this number into perspective, it can be compared with the number of fatal cancers expected in this population from all causes. The 1990 mortality rate associated with cancer for the entire U.S. population was 0.2 percent per year (Almanac 1993a:839). Based on this national mortality rate, the number of fatal cancers from all causes expected during 1993 in the population living within 80 km (50 mi) of RFETS was 4,400. This number of expected fatal cancers is much higher than the estimated 5×10^{-5} fatal cancers that could result from RFETS operations in 1993.

Table 3.8.9–2. Radiation Doses to the Public From Normal Rocky Flats Environmental Technology Site Operation in 1993 (Committed Effective Dose Equivalent)

Members of the General Public	Atmospheric Releases		Liquid Releases		Total	
	Standard ^a	Actual	Standard ^a	Actual	Standard ^a	Actual
Maximally exposed individual (mrem)	10	0.13	4	0.35	100	0.48
Population within 80 km ^b (person-rem)	None	0.1	None	0 ^c	100	0.1
Average individual within 80 km ^d (mrem)	None	4.5x10 ⁻⁵	None	0 ^c	None	4.5x10 ⁻⁵

^a The standards for individuals are given in DOE Order 5400.5. As discussed in that order, the 10 mrem/yr limit from airborne emissions is required by the CAA, the 4 mrem/yr limit is required by the SDWA, and the total dose of 100 mrem/yr is the limit from all pathways combined. The 100 person-rem value for the population is given in proposed 10 CFR 834 (58 FR 16268). If the potential total dose exceeds this value, it is required that the contractor operating the facility notify DOE.

^b In 1993, this population was approximately 2,200,000.

^c Although the maximally exposed individual receives a dose, no population groups are exposed to any liquid pathways.

^d Obtained by dividing the population dose by the number of people living within 80 km of the site.

Source: RFETS 1994a.

The RFETS workers receive the same dose as the general public from background radiation, but also receive an additional dose from working in the facilities. Table 3.8.9–3 presents the average worker, maximally exposed worker, and cumulative worker dose to RFETS workers from operations in 1992. These doses fall within radiological regulatory limits (10 CFR 835). Based on a risk estimator of 400 fatal cancers per 1 million person-rem among workers (Section M.2.1.2), the number of fatal cancers to RFETS workers from normal operations in 1992 is estimated to be 0.32.

A more detailed presentation of the radiation environment, including background exposures and radiological releases and doses, is presented in the *Site Environmental Report for 1993* (RFP-ENV-93). The concentrations of radioactivity in various environmental media (including air, water, and soil) in the site region (onsite and offsite) are also presented in this reference.

Chemical Environment. The background chemical environment important to human health consists of the atmosphere, which may contain hazardous chemicals that can be inhaled; drinking water, which may contain hazardous chemicals that can be ingested; and other environmental media with which people may come in contact (for example, surface waters during swimming and soil through direct contact or via the food pathway). The baseline data for assessing potential health impacts from the chemical environment are those presented in Section 3.8.3.

Effective administrative and design controls that decrease hazardous chemical releases to the environment and help achieve compliance with permit requirements (for example, air emissions and NPDES permit requirements), contribute toward minimizing potential health impacts to the public. The effectiveness of these controls is verified through the use of monitoring information and inspection of mitigation measures. Health impacts to the public may occur during normal operations at RFETS via inhalation of air containing hazardous chemicals released to the atmosphere by RFETS operations. Risks to public health from other possible pathways, such as ingestion of contaminated drinking water or direct exposure, are low relative to the inhalation pathway.

Table 3.8.9–3. Radiation Doses to Workers From Normal Rocky Flats Environmental Technology Site Operation in 1992 (Committed Effective Dose Equivalent)

Occupational Personnel	Onsite Releases and Direct Radiation	
	Standard ^a	Actual
Average worker (mrem)	ALARA	122
Maximally exposed worker (mrem)	5,000	>10,000 ^b
Total workers ^c (person-rem)	ALARA	800

^a DOE's goal is to maintain radiological exposures as low as reasonably achievable.

^b Three workers received doses that exceeded the standard. Only one worker received a dose greater than 10,000 mrem.

^c The number of badged workers in 1992 was approximately 6,550.

Source: 10 CFR 835, DOE 1993n:7.

Baseline air emission concentrations for hazardous chemicals and their applicable standards are included in the data presented in Section 3.8.3. These concentrations are estimates of the highest existing offsite concentrations and represent the highest concentrations to which members of the public could be exposed. These concentrations are in compliance with applicable guidelines and regulations. Information about estimating health impacts from hazardous chemicals is presented in Section M.3.

Exposure pathways to RFETS workers during normal operations may include inhaling the workplace atmosphere and direct contact with hazardous materials associated with work assignments. The potential for health impacts varies from facility to facility and from worker to worker, and available information is not sufficient to allow a detailed estimation and summation of these impacts. However, the workers are protected from hazards specific to the workplace through appropriate training, protective equipment, monitoring, and management controls. RFETS workers are also protected by adherence to OSHA and EPA standards that limit workplace atmospheric and drinking water concentrations of potentially hazardous chemicals. Appropriate monitoring that reflects the frequency and amounts of chemicals utilized in the operational processes, ensures that these standards are not exceeded. Additionally, DOE requirements (DOE O 440.1) ensure that conditions in the workplace are as free as possible from recognized hazards that cause or are likely to cause illness or physical harm. Therefore, worker health conditions at RFETS are expected to be substantially better than required by the standards.

Health Effects Studies. Several epidemiologic studies have been conducted on communities surrounding RFETS. The studies of surrounding populations have found no substantiated evidence of increased risk of cancers related directly to RFETS. Mixed findings have been reported from studies of workers, with some studies reporting increases in risk of some cancers, others finding no associations, and one reporting a significant deficit in numbers of lung cancers. For a more detailed description of the study findings reviewed, refer to Section M.4.8.

Accident History. A review of recent RFETS annual environmental and accident reports indicates that there have been no radiological or chemical releases that resulted in impacts to workers, members of the public, or the environment. The review was performed to support the affected environment presentation in the *Nonnuclear Consolidation Environmental Assessment* published in June 1993 (DOE/EA-0792).

Emergency Preparedness. Each DOE site has established an emergency management program that would be activated in the event of an accident. This program has been developed and maintained to ensure adequate response for most accident conditions and to provide response efforts for accidents not specifically considered. The emergency management program incorporates activities associated with emergency planning, preparedness, and response.

The RFETS has comprehensive emergency plans that provide guidance and procedures that are designed to protect life and property within the facility, the health and welfare of surrounding metropolitan communities, and the defense interests of the nation during any credible emergency situation. Mutual assistance and coordination with Federal, State, and local agencies is ensured on a cooperative basis.

The DOE Rocky Flats Area Office Manager coordinates activities for emergencies affecting offsite personnel or property and is responsible for communication with the supporting Federal, State, and local agencies. The DOE Rocky Flats Area Office Manager may obtain further assistance through the Interagency Radiological Assistance Plan, which provides that each of the signatory Federal agencies will assist one another in the event of a major emergency involving radioactivity.

The Rocky Flats Emergency Plan expresses the philosophy that RFETS be as self-sufficient as possible in handling onsite emergency situations. Assistance may be requested from outside sources through written agreements with St. Anthony Hospital, St. Luke's Hospital, University of Colorado, Jefferson County Sheriff's Office, and the Federal Bureau of Investigation.

In the event of an offsite emergency, the *Rocky Flats Radiological Assistance Plan* interfaces with the *DOE Radiological Assistance Plan*, the *Interagency Radiological Assistance Plan*, and the Joint Nuclear Accident Coordinating Center through the DOE Rocky Flats Area Office at Rocky Flats. Also, in the event of an incident at RFETS involving the release of radioactive material that may endanger the health and safety of the general public, the *Colorado Radiological Emergency Response Plan* would be activated.

3.8.10 WASTE MANAGEMENT

This section outlines the major environmental compliance program and ongoing waste management activities for RFETS. Table 3.8.10-1 presents a summary of waste management activities at RFETS for 1995.

The Department is working with Federal and State regulatory authorities to address compliance and cleanup obligations arising from its past operations at RFETS. DOE is engaged in several activities to bring its operations into full regulatory compliance. These activities are set forth in negotiated agreements that contain schedules for achieving compliance with applicable requirements, and financial penalties for nonachievement of agreed-upon milestones.

The focus of the RFETS mission is on environmental restoration and possible economic development. The legal framework establishing the scope and schedule for projects in the environmental restoration program is the Interagency Agreement. The agreement integrates the actions required under the authority and jurisdiction of CERCLA and RCRA. Therefore, the investigative phase at each operable unit is referred to as a RCRA Facility Investigation/Remedial Investigation, and the selection of remedial alternatives is referred to as a Corrective Measures Study/Feasibility Study. The primary objective of the environmental restoration program is to assess and clean up RFETS in compliance with applicable environmental laws and regulations. The approach being taken is to reduce health risk and accelerate cleanup.

There have been, 177 contaminated sites previously identified and prioritized that are located both on RFETS and offsite. These sites were grouped into 16 operable units according to location and type of contamination. Per the new Cleanup Agreement, dated July 19, 1996, DOE, the State of Colorado, and EPA have proposed defining the existing 16 operable units into 7. The primary benefit of consolidating operable units is the reduced process and administrative requirements. The resulting cost saving can then be applied to environmental remediation or other higher priority tasks at RFETS.

Waste disposal activities include the shipment of saltcrete to an offsite commercial facility for disposal, LLW for shipment to NTS and Hanford; the preparation, transportation, and disposal of hazardous and other regulated wastes by commercial vendors; and the disposal of sanitary waste in the onsite landfill. RFETS manages the following waste categories: TRU, low-level, hazardous, mixed, and nonhazardous. A discussion of the waste management operations associated with each of these waste categories follows.

Spent Nuclear Fuel. The RFETS does not generate or manage spent nuclear fuel.

High-Level Waste. The RFETS does not generate or manage HLW.

Transuranic Waste. Transuranic waste at RFETS was generated as a result of Pu operations and its supporting functions such as Pu metal purification. TRU and mixed TRU waste generated at RFETS before 1970 was shipped to INEL and disposed of underground. After 1970, this waste was shipped to INEL for interim storage until a permanent disposal facility became available. As a result of delays in opening WIPP in Carlsbad, New Mexico, the Governor of the State of Idaho placed a moratorium on out-of-State waste shipments to INEL in October 1988, forcing RFETS to store TRU and mixed TRU waste onsite. However, this storage was found to violate RCRA storage provisions and led to several interim agreements.

Storage of TRU and mixed TRU wastes at RFETS is governed by the provisions of the Colorado Department of Health Settlement Agreement and Compliance Order on Consent, Number 89-07-10-01, related to mixed wastes, that was signed on July 14, 1989. The Order required RFETS to submit a Part A Permit Application for all its interim status mixed TRU and mixed LLW storage and treatment units. The Order also granted interim status to all mixed TRU waste units, except unit 60, included in applications filed by July 1, 1988. It also granted interim status to units used for storage and treatment of hazardous and mixed LLW identified in an August 2, 1988, Part A Application.

Table 3.8.10-1. Waste Management Activities at Rocky Flats Environmental Technology Site

Waste Category	1995 Generation ^a		Treatment Capacity (m ³ /yr)	Storage Method	Storage Capacity (m ³)	Disposal Method	Disposal Capacity
	(m ³)	Treatment Method					
Transuranic							
Liquid	<1	Solidification	Included in liquid mixed LLW	None	NA	NA	NA
Solid	54	Compaction	Included in solid mixed LLW	Drums on pads	1,500 ^b	None - WIPP or alternate facility in the future	NA
Transuranic (Mixed)							
Liquid	<1	Solidification	Included in liquid mixed LLW	None	NA	NA	NA
Solid	23	Compaction	Included in solid mixed LLW	Drums on pads	1,300 ^c	None - WIPP or alternate facility in the future	NA
Low-Level							
Liquid	4	Evaporation and Solidification	Included in liquid mixed LLW	Staged	105 ^d	NA	NA
Solid	752	None	None	Staged	4,540 ^d	Offsite - DOE	NA
Hazardous							
Liquid	2	Neutralization & Precipitation	None	Staged in DOT containers	Included in solid hazardous waste	Offsite	NA
Solid	24	None	None	Staged in DOT containers	263 ^e	Offsite	NA
Mixed (Low-Level)							
Liquid	165	Solidification	47,700 ^f	Staged for treatment	Included in solid mixed LLW	None	NA
Solid	676	None	7,100 ^{g,h}	DOT containers	13,600 ⁱ	Offsite	NA
Nonhazardous (Sanitary)							
Liquid	457,600 ^j	Sedimentation	568,000	None	NA	Surface water	NA
Solid	11,400	None	None	None	NA	Onsite landfill	Expandable

Table 3.8.10-1. Waste Management Activities at Rocky Flats Environmental Technology Site—Continued

Waste Category	1995 Generation ^a		Treatment		Storage Method	Storage Capacity (m ³)	Disposal Method	Disposal Capacity
	(m ³)	Treatment Method	Capacity (m ³ /yr)					
Nonhazardous (Other)								
Liquid	Included in liquid sanitary	Sedimentation	Included in sanitary	None	None	NA	Included in sanitary	Included in sanitary
Solid	73	None	None	None	None	NA	Included in sanitary	Included in sanitary

^a Values per RFETS Comprehensive Waste Management Plan

[Text deleted.]

^b Value taken from Draft Waste Management Programmatic Environmental Impact Statement for Managing Treatment, Storage, and Disposal of Radioactive and Hazardous Waste.

[Text deleted.]

^c Value taken from RFETS Proposed Site Treatment Plan dated March 1995 and is based on the sum of the current mixed-TRU storage and the expected 20-year generation.

[Text deleted.]

^d Cumulative volume of LLW stored at the end of 1993 as per a memorandum from McGlochin, EG&G to Reece, DOE on updated information for nonnuclear consolidation EA.

[Text deleted.]

^e Value based on the 1991 Waste Storage Inventory Report and the memorandum from McGlochin, EG&G to Reece, DOE on updated information for nonnuclear consolidation EA.

^f Based on the operating capacities of Buildings 374 and 774 as described in the 1995 Mixed Waste Inventory Report.

^g Based on the operating capacities of Building 776 as described in the 1995 Mixed Waste Inventory Report.

^h Value calculated using the conversion ratio of 1,500 kg/m³.

ⁱ Value taken from RFETS Proposed Site Treatment Plan dated March 1995 and is based on the mixed-LLW in storage at RFETS.

^j Value taken from 1993 RFETS Site Environmental Report and Reflects Annual Discharge From Main Collection Pond 68 (Pond A-4).

Note: NA=not applicable.

Source: DOE 1995cc; DOE 1995gg; RF DOE 1995b; RF DOE 1995c; RF EG&G 1992e; RFETS 1995a.1; RFETS 1995a.2; RFP 1993a.1.

Finally, the order set total capacity limit for interim status container storage for mixed TRU waste at 1,220 m³ (1,601 yd³) (RF DOH 1989b:7), yet a capacity exists for 1,500 m³ (1,960 yd³). The *Federal Facility Compliance Act* of 1992 requires DOE to develop site-specific mixed waste treatment plans and to submit the plans to EPA or the authorized State for approval. The final proposed plan was published in March, 1995.

As a temporary solution to the 1,220 m³ (1,601 yd³) limit, the Supercompaction and Repackaging Facility in Building 776 is used to compact and package solid TRU and mixed TRU wastes generated during various site operations. This facility processes both soft, combustible waste (such as paper and plastic) and hard, noncombustible waste (such as metal and glass). Supercompaction and Repackaging Facility equipment is contained in a single, large glovebox. The Supercompaction and Repackaging Facility allows repackaging operations to be performed inside the glovebox, reducing exposure to workers. An overall 5-to-1 volume reduction of waste by this facility is being achieved.

Residues at RFETS are Pu recovery byproducts (for example, salts and contaminated materials) that were determined to contain enough Pu to justify further processing for recovery. In the past, DOE has not considered residues at RFETS to be a waste form. Events at RFETS have led to the classification of these Pu residues as waste. A very limited quantity of the Pu residues at RFETS are considered to be mixed waste based upon a court judgement. These mixed residues have been managed under a series of compliance orders, agreements, settlements, and judicial orders.

The need to treat mixed TRU waste is being assessed as part of the WIPP test phase. If the no-migration exemption for WIPP is granted, mixed TRU wastes going to WIPP would only need to meet hazardous substance transportation requirements and WIPP WAC before shipment. If not approved, then treatment of mixed TRU waste would be required under 40 CFR 191 (disposal standards) to remove or reduce to acceptable levels the land disposal restriction constituents in the waste before shipment and disposal.

Low-Level Waste. The baler located in Building 889 processes solid LLW (soft combustibles) generated outside the PA. The baler is also being evaluated for volume-reducing beryllium and mixed LLW generated outside the PA, but some or all of the following improvements will be required in order to meet the following applicable requirements: equipment must be upgraded and rearranged; ventilation must be upgraded; and building modifications must be made to meet safety requirements.

Mixed Low-Level Waste. A great deal of the solid radioactive waste at RFETS consists of mixed LLW. Mixed LLW shipments to NTS were suspended in May 1990 when the RCRA LDR went into effect. In order to transport and receive wastes, NTS has to meet certain regulatory requirements. They must be either adequately characterized or treated to prove that hazardous constituents in these wastes are below treatment standards.

The Department and EPA entered into an FFCA for LDR wastes on May 20, 1991. This agreement requires DOE to submit the following: a Comprehensive Treatment and Management Plan addressing treatment proposed for RFETS nonresidue mixed wastes so as to come into compliance with the treatment and storage requirements of RCRA; a Waste Minimization Plan identifying process changes proposed to minimize or eliminate wastes; and an Annual Progress Report evaluating Rocky Flats' progress in achieving compliance with the RCRA LDR.

Negotiations began in June 1992 for a new agreement (FFCA). However, the intervening FFCA and its requirement for a site treatment plan compliance order will most likely obviate the need for an FFCA. Pending any new agreement, DOE will continue to manage its mixed waste compliance program in accordance with the existing FFCA. For example, the Waste Minimization Program Plan, Waste Stream and Residue Identification and Characterization Report, and the Annual Progress Report continue to be updated and submitted on an annual basis. However, because the FFCA gives the State primacy in approval of the site treatment plan and issuance of a compliance order, Colorado Department of Health is now considered the lead regulatory agency in regard to the DOE mixed waste compliance program. Current plans call for the disposal of saltcrete at Envirocare of

Utah. Disposal of saltcrete is planned in a proposed RCRA Subtitle C disposal cell. The remaining mixed LLW will either be disposed of at commercial facilities or at NTS.

Residues are process byproducts that contain radioactive materials in concentrations greater than the economic discard limit, and were destined for recycle to recover the radioactive materials. Those residues that contain hazardous constituents are undergoing characterization to determine how to comply with RCRA and court orders. DOE is presently determining how and where to store those residues it decides to retain. It is planned to remove all mixed residues by 1999.

The Department and the State signed the Residue Compliance Agreement and Consent Order on November 3, 1989, which requires DOE to submit a plan for removing all mixed residue inventory at RFETS by January 1, 1999. Also, the U.S. District Court, Colorado, issued a Judgment and Order on August 13, 1991, which declared that RFETS mixed residues were hazardous materials and must be managed in accordance with RCRA and further ordered that DOE must obtain a permit for the mixed residues currently stored without a RCRA permit. If no such permit is obtained, RFETS may not continue operations which generate hazardous or mixed waste, save certain limited exceptions.

The plan for removal of mixed residues from RFETS contains four primary ways of dealing with these residues: ship as waste or product, remove the RCRA characteristic, remove actinides and ship the resultant wastes, and remove stored solutions (RF DOE 1992a:8). All of the Pu-bearing residues in the backlog will undergo inspection and segregation so that the particular process path to be used can be identified or verified.

[Text deleted.]

Hazardous Waste. Treatment of hazardous wastes at RFETS is limited to organic liquid wastes. Hazardous wastes are shipped to various RCRA-permitted, commercial vendors for disposal. In 1991, DOE and the Colorado Department of Health agreed on radioactivity limits for waste garage oils; this waste form is now being shipped to a commercial vendor for recycle.

Nonhazardous Waste. The DOE and EPA agreed to, and signed on March 25, 1991, an *Federal Facility Compliance Act* for the NPDES program. The agreement requires the following actions:

- Upgrade the sewage treatment plant and change sewer sludge and spray irrigation management practices
- Enhance groundwater monitoring for the sewage sludge drying beds
- Prepare a compliance plan describing those actions necessary for the RFETS to remain in compliance with the NPDES permit
- Submit to EPA a variety of new reports and studies describing the status of compliance

The sanitary landfill on RFETS accepts all solid nonhazardous wastes. Liquid nonhazardous waste is treated and released to surface waters.

3.9 LOS ALAMOS NATIONAL LABORATORY

Los Alamos National Laboratory was established in 1943 as a nuclear weapons design laboratory and was formerly known as the Los Alamos Scientific Laboratory. Its facilities are located in north central New Mexico about 40 km (25 mi) northwest of Santa Fe. Figure 2.2.8-1 indicates the regional location of LANL and Figure 2.2.8-2 shows the locations of the technical areas which contain the major facilities within the site boundaries. LANL is owned by DOE and operated by the University of California under contract to DOE.

The central mission of LANL has evolved from developing the first atomic bomb during World War II to developing nuclear weapons for deterrence during the Cold War. With the recent easing of international tensions, the central mission of LANL has been redefined to one of developing a multidisciplinary science and technology research facility that is engaged in a variety of programs for DOE and other Government agencies and applying this expertise to the Nation's security and well being. Current missions at LANL are listed in Table 3.9-1.

Table 3.9-1. Current Missions at Los Alamos National Laboratory

Mission	Description	Sponsor
Nuclear weapons	Stockpile stewardship and management, materials support, fissile materials disposition	Assistant Secretary for Defense Programs
Environmental management	Environmental restoration, waste management, pollution prevention, technology development	Assistant Secretary for Environmental Management
Nonproliferation and international security	Nonproliferation and verification R&D, nuclear safeguards and security, arms control and nonproliferation, intelligence	Office of Intelligence and National Security
Energy research	Nuclear physics, biological and environmental research, basic energy sciences, magnetic fusion, high energy physics	Office of Energy Research
Energy technology	Enhanced energy production, improved energy efficiency, environmental consequences, medical radioisotope production	Assistant Secretary for Energy Efficiency and Renewable Energy; Assistant Secretary for Fossil Energy; Offices of Nuclear Energy and Civilian Radioactive Waste Management
Work for others	Conventional weapons technology, modeling and simulation, beams and sensors, high performance computing	DoD, NRC, other Federal and non-Federal entities.

Source: LANL 1995b:1.

Department of Energy Activities. The major DOE program activities at LANL include defense, environmental management, nonproliferation and international security, and energy research and technology. These programs, as well as others at LANL, are interdependent and have considerable overlap. Defense programs address nuclear weapons technology, nuclear materials and reconfiguration technology, and programs conducted by the Los Alamos Neutron Scattering Center (LANSCE) and Energy Research Program Office. Environmental management programs are primarily focused on restoration activities and attaining and maintaining compliance with all Federal and State regulations and permits for waste management. The nonproliferation and international security programs respond to the scientific and technological needs to assure the effective reduction in the proliferation of nuclear weapons, the means to deliver them, and to ensure U.S. and international security.

Energy research and technology programs principally address basic science and technology issues that contribute significantly to defense, national security, industrial competitiveness, and energy resources.

The Nuclear Weapons Technology Program is the principal defense program at LANL and is devoted to providing technology stewardship for the nuclear stockpile. Important aspects of stockpile stewardship at LANL include stockpile surveillance, surety, and aboveground experiments, all of which help in the absence of underground nuclear testing. The Nuclear Materials and Stockpile Management (NMSM) Program addresses a wide spectrum of activities in nuclear materials handling, processing, and fabrication in support of the DOE objectives of reducing the nuclear danger and addressing cleanup issues across the DOE complex. Two major interfaces for NMSM are the stockpile support and reconfiguration/nuclear materials management programs. LANL continues to support DOE's stockpile evaluation and pit rebuild efforts. Stockpile evaluation is currently focused on surveillance of milliwatt radioisotopic thermoelectric generators, surveillance of selected gas systems, and the pit surveillance effort, which was formerly conducted at RFETS.

The LANSCE and L/ER conduct several programs in the areas of science and technology that contribute to a wide spectrum of fundamental and strategic research. In addition to research activities, L/ER programs operate a major user facility for neutron research and applications supporting research by DP users, among others.

Environmental Management Program activities at LANL consist of environmental restoration, waste management, pollution prevention, independent technical assessments and environmental technology development. The major environmental management effort at LANL is assessing and remediating over 2,000 sites that may have been contaminated over the past 50 years and have been designated for corrective action investigations. One component of the environmental restoration program is the D&D of sites and facilities such as nuclear reactors and surplus contaminated facilities. Waste management activities are directed at attaining and maintaining compliance with all regulations and permits.

The Nonproliferation and International Security Program was created at LANL to develop and apply the science and technology capabilities needed to deter, detect, and respond to proliferation of weapons of mass destruction and thereby to help ensure U.S. and international security. Those LANL programs to control and prevent the proliferation of nuclear weapons throughout the world that are funded within the nuclear weapons research, development, and technology program are focused primarily on nuclear counterproliferation and emergency response issues.

In addition to the neutron research and applications at LANSCE, other related energy research includes nuclear and high energy physics, basic energy sciences, biological and environmental research, and fusion energy. Energy technology programs at LANL include energy production, energy utilization, and the environmental consequences of energy production and utilization. Energy production programs are funded by the Assistant Secretary for Defense Programs as well as the other DOE energy-source-specific program offices. The type of effort performed for the Assistant Secretary for Defense Programs is in the area of nuclear safety review work for both reactor and nonreactor facilities.

Non-Department of Energy Activities. Non-DOE activities at LANL include support to DoD, NRC, other Federal agencies (National Aeronautics and Space Administration, National Institutes of Health, NOAA, National Science Foundation, and others), and various other institutions and industries. For DoD and branches of the military, LANL provides support in the areas of conventional weapons technology; modeling and simulation; beams and sensors; high performance computing; and advanced concepts in structures and materials, nonlethal technologies, unmanned aerial vehicles, missiles, micromachines, and other state-of-the-art technological applications.

3.9.1 LAND RESOURCES

Land Use. The LANL is located in north-central New Mexico, 97 km (60 mi) north-northeast of Albuquerque, 40 km (25 mi) northwest of Santa Fe, and 32 km (20 mi) southwest of Española in Los Alamos and Santa Fe Counties. The associated communities of Los Alamos and White Rock are in Los Alamos County. The 11,300-ha (28,000-acre) LANL site and adjacent communities are situated on the Pajarito Plateau, which consists of a series of finger-like mesas separated by deep canyons that run from the Jemez Mountains on the west toward the Rio Grande Valley on the east. Mesa tops range in elevation from approximately 2,400 m (7,800 ft) on the west to about 1,900 m (6,200 ft) on the east (LANL 1994a:II-1,II-2).

Existing Land Use. The developed acreage of LANL consists of 30 active TAs. These TAs consist of laboratory facilities and support infrastructure. They account for only a small portion of the total land area at LANL. Most of LANL is undeveloped to provide security, safety, and expansion possibilities for future mission requirements. There are no agricultural activities present at LANL, nor are there any prime farmlands. In 1977, DOE designated LANL as a NERP, which is used by the national scientific community as an outdoor laboratory to study the impacts of human activities on the pinyon-juniper woodland ecosystems (DOE 1985a:3,21).

Most developments within Los Alamos County are confined to mesa tops. Generalized land uses are shown in Figure 3.9.1-1. The surrounding land is largely undeveloped with large tracts north, west, and south of the LANL site administered by the U.S. Forest Service (Santa Fe National Forest), the National Park Service (Bandelier National Monument), and Los Alamos County. The San Ildefonso Pueblo borders the LANL site to the east (LANL 1994a:II-1,II-2). The closest offsite residences to LANL are approximately 3 m (10 ft) from the northern boundary.

Land-Use Planning. The *Site Development Plan Annual Update 1993* Master Plan designates TA-55 as Special Nuclear Material Research and Development. The *Site-Wide Environmental Impact Statement for Los Alamos National Laboratory* (LANL Site-Wide EIS) is currently being prepared and analyzes four future alternatives for LANL's operation over the next 5 to 10 years. An analysis of future operation, facilities, and buffer zones would be anticipated to be included (LANL 1996e:4).

Land-use planning occurs at the local level in New Mexico, with counties and cities preparing future land-use plans called comprehensive plans or general plans. Los Alamos County has a comprehensive plan and a development code that contains zoning. However, LANL is autonomous from a planning perspective and therefore, is not addressed in the county plan and code (NM County 1996a:1). The *Santa Fe County General Plan* land-use designations are based on groundwater protection goals. Therefore, the Plan designates LANL as "Agricultural and Residential" (NM County 1996a:2).

Visual Resources. Development and operation of DOE facilities has disturbed the character of the landscape in their respective areas. The DOE facilities are generally brightly lit at night and highly visible from nearby viewpoints, and are visible from as far away as southeast Santa Fe (approximately 48 km [30 mi]). The developed areas of LANL are consistent with a VRM Class 5 designation. The remainder of LANL ranges from VRM Class 3 to Class 4 designation.

Offsite viewpoints affected by DOE facilities are primarily associated with the Los Alamos townsite and New Mexico State Highways 4, 501, and 502. On a clear day, views can exceed 80 km (50 mi). Topographic relief and heavy vegetation provide significant visual screening of LANL facilities, especially from mid- and long-distance viewpoints.

3.9.2 SITE INFRASTRUCTURE

Baseline Characteristics. Section 3.9 describes the current LANL missions. Baseline characteristics are shown in Table 3.9.2-1.

Table 3.9.2-1. Los Alamos National Laboratory Baseline Characteristics

Characteristics	Current Usage	Site Availability
Transportation		
Roads (km)	137	137
Railroads (km)	0	0
Electrical		
Energy consumption (MWh/yr)	381,425	500,000
Peak load (MWe)	87	100
Fuel		
Natural gas (m ³ /yr)	43,414,560	103,368,000
Oil (l/yr)	0 ^a	0 ^a
Coal (t/yr)	0	0
Steam (kg/hr)	33,554	234,000

^a Oil is stored as a backup fuel source for natural gas.

Source: LANL 1990b; LANL 1995b:1.

The major existing highways that serve LANL are depicted on Figure 2.2.8-1. LANL is served by an extensive system of roads and parking facilities. Roadways are aligned with the predominant topography of east/west canyons and mesas. Cross-canyon travel is limited to the Los Alamos Canyon Bridge, West Road, and State Route 4 to the southeast. There are approximately 137 km (85 mi) of paved roads and 113 km (70 mi) of dirt or gravel roads and fire lanes. All materials shipped from locations outside LANL are first received or shuttled through TA-3. The nearest rail service is in Santa Fe, approximately 40 km (25 mi), southeast of LANL.

Locally, LANL is supplied with electricity by a Los Alamos County/DOE power pool. It also has a 20 MWe gas-fired generating plant in TA-3. Electricity is transmitted to the site and the County over two 115 kV lines, one from Santa Fe (Norton Generating Station) and one from Albuquerque (Reeves Generating Station). These lines enter LANL near TA-5 (Eastern Technical Area substation). Electricity is distributed throughout the site via 13.2 kV lines. The 115 kV system includes a loop that ties substations at TAs -3, -5, and -53 together. This looping ensures a power supply throughout LANL should outages occur in any major line. The total annual power consumption is considerably below the transmission capacity of the system. The sub-regional electric power pool from which LANL draws its power is the Arizona-New Mexico Power Area. Capabilities of this power pool are summarized in Table 3.9.2-2.

Table 3.9.2-2. Arizona-New Mexico Sub-Regional Power Pool Electrical Summary

Characteristics	Energy Production
Type Fuel^a	
Coal	57%
Nuclear	24%
Hydro/geothermal	4%
Oil/gas	15%
Other ^b	0.3%
Total Annual Production	79,491,000 MWh
Total Annual Load	83,794,000 MWh
Energy Imported Annually^c	4,325,000 MWh
Generating Capacity	17,023 MWe
Peak Demand	15,679 MWe
Capacity Margin^d	3,081 MWe

^a Percentages do not total 100 percent due to rounding.

^b Includes power from both utility and nonutility sources.

^c Energy imported is not the difference of production and load due to negative net pumped storage.

^d Capacity margin is the amount of generating capacity available to provide for scheduled maintenance, emergency outages, system operating requirements, and unforeseen electrical demand.

Source: NERC 1993a.

Natural gas is supplied to LANL from the San Juan Basin in northwest New Mexico. The lines are owned by DOE but operated and maintained by the Gas Company of New Mexico under contract to DOE. LANL depends on natural gas for most space heating requirements. Gas-fired forced air furnaces, hot water boilers, and steam boilers are some of the equipment used. Natural gas is distributed to buildings directly, or to three central steam plants (TAs -3, -16, and -21), and a standby plant for fueling the heating system. All plants also maintain reserves of fuel oil.

Water for LANL and adjacent areas (including Los Alamos townsite, White Rock, and Bandelier National Monument) primarily comes from three DOE-owned well fields and surface water from the Jemez Mountains. The system depends on gravity flow for distribution from high elevation terminal storage facilities.

Plutonium is stored in approximately 9,400 packages at 24 facilities within LANL. More than 90 percent of LANL's Pu inventory is located in 7,700 packages stored at the TA-55 facility. Research at the TA-55 facility includes Pu recovery processes, Pu metal fabrication, Pu-238 general purpose heat source and radioisotope thermoelectric generator production, and advanced fuel fabrication. Renovation of the Nuclear Materials and Storage Facility at TA-55 has been proposed to correct design and construction deficiencies that have prevented the use of this facility and to ensure that the facility can be operated safely and effectively. Operation of this facility would provide a centralized capability for consolidation and intermediate and long-term storage for LANL nuclear material inventories.

Plutonium analytical operations are conducted in the TA-3 CMR Building (SM-29), which has laboratories, hot cells, a waste assay facility and a vault. The Los Alamos Critical Experiments Facility, remotely located in TA-18, uses Pu in nuclear criticality experiments. These experiments generate insignificant quantities of fission and activation products. The critical assemblies are in buildings called kivas. Pu in metal and oxide forms is stored in vaults in each kiva and also in the Hillside Vault. There are also 21 other technical areas that store small quantities of Pu materials.

3.9.3 AIR QUALITY AND NOISE

Meteorology and Climatology. Los Alamos has a semiarid, temperate mountain climate. The climate averages for atmospheric variables such as temperature, pressure, moisture, and precipitation are based on observations made at the TA-59 LANL weather station from 1961 through 1993. The meteorological conditions described here are representative of conditions on the Pajarito Plateau at an elevation of approximately 2,250 m (7,400 ft) above sea level (LANL 1995s:II-8). In July, the average daily high temperature is 27.2 °C (81 °F), and the average nighttime low temperature is 12.8 °C (55 °F). The average January daily high is 4.4 °C (40 °F), and the average nighttime low is -8.3 °C (17 °F). The highest recorded temperature is 35 °C (95 °F), and the lowest recorded temperature is -27.8 °C (-18 °F). The large daily range in temperature of approximately 13 °C (23 °F) results from the site's relatively high elevation and dry, clear atmosphere, which allows high insolation during the day and rapid radiative losses at night (LANL 1995s:II-8). Additional information related to meteorology and climatology at LANL is presented in Appendix F.

The average annual precipitation is 47.6 cm (18.7 in) but is quite variable from year to year. The lowest recorded annual precipitation is 17.3 cm (6.8 in), and the highest is 77.1 cm (30.3 in). The maximum precipitation recorded for a 24-hour period is 8.8 cm (3.5 in) (LANL 1995s:II-11). Because of the eastward slope of the terrain, there is a large east-to-west gradient in precipitation across the plateau. White Rock often receives about 13 cm (5 in) less annual precipitation than the TA-59 weather station, and the eastern flanks of the Jemez Mountains often receive about 13 cm (5 in) more (LANL 1994a:II-11).

Los Alamos winds are generally light, averaging 2.8 m/s (6.3 mph). Strong winds are most frequent during the spring when peak gusts often exceed 22 m/s (50 mph). The highest recorded wind gust was 34.4 m/s (77 mph). The semiarid climate promotes strong surface heating by day and strong radiative cooling by night. Because the terrain is complex, heating and cooling rates are uneven over the LANL area, which results in local thermally generated winds (LANL 1995s:II-11).

Ambient Air Quality. The LANL is located within the New Mexico Intrastate AQCR 157. None of the areas within LANL and its surrounding counties are designated as nonattainment areas with respect to any of the NAAQS (40 CFR 81.332). A nonattainment area is an area that has air quality worse than designated by NAAQS for one or more criteria pollutants. Applicable NAAQS and New Mexico State ambient air quality standards are presented in Appendix F.

The criteria pollutants—NO₂, CO, hydrocarbons, PM₁₀, and SO₂—make up approximately 79 percent of the stationary source emissions at LANL. The source of these criteria pollutants is combustion in power plants, steam plants, asphalt plants, and local space heaters. Toxic and other hazardous pollutants represent the remaining 21 percent of emissions from stationary sources at LANL. These emissions are generated by equipment surface cleaning, coating processes, and acid baths, and include gases, vapors, metal dusts, and miscellaneous emissions, such as wood dust, hazardous gases, and plastics (LANL 1994a:VI-1, VI-3).

One PSD Class I Area, the Bandelier National Monument's Wilderness Study Area, borders LANL to the south. To date, LANL has not been subject to PSD requirements (LANL 1993b:III-20).

Ambient concentration limits for hazardous/toxic air pollutants (to be used by the State as one of the criteria in evaluating construction permit applications for a new emission source) have been approved by the New Mexico Environmental Improvement Board. The estimated 2005 No Action annual emission rates from LANL facilities are listed in Table F.1.2.9-1. Estimates of maximum ground-level concentrations at or beyond the LANL boundary are listed in Table 3.9.3-1. Concentrations of criteria and hazardous/toxic air pollutants are in compliance with applicable guidelines and regulations. The hazardous/toxic air pollutant limits are one-hundredth of the recognized occupational exposure levels (for example, 8-hour time-weighted threshold limit values).

Table 3.9.3-1. Comparison of Baseline Ambient Air Concentrations With Most Stringent Applicable Regulations or Guidelines at Los Alamos National Laboratory, 1990 and 1992

Pollutant	Averaging Time	Most Stringent Regulation or Guideline ($\mu\text{g}/\text{m}^3$)	Baseline Concentration ($\mu\text{g}/\text{m}^3$)
Criteria Pollutants			
Carbon monoxide	8-hour	7,689 ^a	115
	1-hour	11,578 ^a	630
Lead	Calendar quarter	1.5 ^b	<0.01
Nitrogen dioxide	Annual	73 ^a	3.8
	24-hour	145 ^a	^c
Ozone	1-hour	235 ^b	^d
Particulate matter less than or equal to 10 microns in diameter ^e	Annual	50 ^b	8
	24-hour	150 ^b	21
Sulfur dioxide	Annual	40 ^a	1.3
	24-hour	202 ^a	^c
	3-hour	1,300 ^b	^c
Mandated by the State of New Mexico			
Hydrogen sulfide	1-hour	11 ^a	^c
Total reduced sulfur	30-minute	3 ^a	^c
Total suspended particulate ^e	Annual	60 ^a	8
	30-day	90 ^a	<21
	7-day	110 ^a	<21
	24-hour	150 ^a	21
Hazardous and Other Toxic Compounds^f			
Acetic acid	8-hour	250 ^a	2.87
Ammonia	8-hour	180 ^a	4.27
2-Butoxyethanol	8-hour	1,200 ^a	0.66
Chlorine	8-hour	^g	0.07
Chloroform	8-hour	500 ^a	2.92
Ethyl acetate	8-hour	14,000 ^a	0.49
Ethylene glycol	8-hour	^g	0.39
Formaldehyde	8-hour	15 ^a	0.27
Heavy metals	8-hour	^g	0.62
Heptane (n-heptane)	8-hour	^g	10.12
Hexane (n-hexane)	8-hour	^g	0.41
Hydrogen chloride	8-hour	^g	3.41
Hydrogen fluoride	8-hour	^g	1.29
Isopropyl alcohol	8-hour	9,800 ^a	2.88
Kerosene	8-hour	^g	1.42
Methyl alcohol	8-hour	^g	3.14
Methyl ethyl ketone	8-hour	^g	9.95
Methylene chloride	8-hour	^g	5.90
Nickel	8-hour	10 ^a	0.30
Nitric acid	8-hour	50 ^a	3.53

Table 3.9.3–1. Comparison of Baseline Ambient Air Concentrations With Most Stringent Applicable Regulations or Guidelines at Los Alamos National Laboratory, 1990 and 1992—Continued

Pollutant	Averaging Time	Most Stringent Regulation or Guideline ($\mu\text{g}/\text{m}^3$)	Baseline Concentration ($\mu\text{g}/\text{m}^3$)
Hazardous and Other Toxic Compounds^f (Continued)			
Nitrogen oxide	8-hour	^g	2.29
Nonmethane hydrocarbons	8-hour	^g	15.83
Propane sulfone	8-hour	400 ^a	1.12
Stoddard solvent	8-hour	5,250 ^a	1.41
Toluene	8-hour	^g	13.2
1,1,2-Trichloroethane	8-hour	^g	4.95
Trichloroethylene	8-hour	^g	1.12
Tungsten (as W)	8-hour	50 ^a	0.60
VM&P Naphtha	8-hour	13,500 ^a	3.27
Welding fumes	8-hour	^g	2.8
Xylene	8-hour	^g	9.41

^a State standard. The conversion from ppm to $\mu\text{g}/\text{m}^3$ for the ambient air quality standard is calculated with the corrections for temperature (530 °Rankine) and pressure (elevation) 2,255 m mean sea level.

^b Federal standard.

^c No monitoring data available; baseline concentrations assumed less than applicable standard.

^d Ozone, as a criteria pollutant, is not directly emitted or monitored by the site. See Section 4.1.3 for a discussion of ozone-related issues.

^e It is assumed that all particulate matter concentrations are total suspended particulate concentrations.

^f Compounds listed are the major pollutants (11.34 kg/yr or more) of concern.

^g No standard.

Source: 40 CFR 50; DOE 1995hh; LANL 1993b; LANL 1994a; NM EIB 1995a; NM EIB 1996a.

Table 3.9.3–1 presents the baseline ambient air concentrations for criteria pollutants for 1992 and other pollutants of concern for 1990 at LANL. As shown in the table, baseline concentrations are in compliance with applicable guidelines and regulations.

Noise. The major noise sources at LANL include various facilities, equipment, and machines (for example, cooling towers, transformers, engines, pumps, boilers, steam vents, paging systems, construction and materials-handling equipment, vehicles, pistol and rifle firing range, and explosives detonation). No LANL environmental noise survey data are available. At the LANL boundary, away from most of the industrial facilities, noise from most of these sources is barely distinguishable from background noise levels.

Impulsive noise from explosive testing can be heard occasionally in Los Alamos Townsite, White Rock Communities, and Bandelier National Monument. The acoustic environment along the LANL boundary away from traffic noise, although not measured, is expected to be that of a rural location with typical DNL levels in the range of 35 to 50 dBA (EPA 1974a:B-4). Traffic is the primary source of noise at the site boundary and residences near roads. The acoustic environment in the town of Los Alamos is similarly expected to be that of a suburban location with typical DNL in the range of 53 to 62 dBA (EPA 1974a:B-5).

The State of New Mexico has not established specific numeric environmental noise standards applicable to LANL. Los Alamos County has adopted a noise ordinance that specifies maximum sound levels in residential areas. (This ordinance is discussed in Appendix F.) Although the maximum levels specified by the ordinance

and the EPA guideline may be exceeded occasionally at the LANL boundary, this is expected to be attributable to traffic noise and not to sources at LANL; the ordinance does not apply to traffic noise.

3.9.4 WATER RESOURCES

Surface Water. The Rio Grande is the major surface water feature in north-central New Mexico. All surface water drainage and groundwater discharge from the Pajarito Plateau ultimately arrives at the Rio Grande. The Rio Grande at Otowi, just east of Los Alamos, has a drainage area of 37,037 km² (14,300 mi²) in southern Colorado and northern New Mexico.

The major canyons that contain reaches of ephemeral streams within LANL are Pajarito, Water, Ancho, and Chaquehui Canyons (Figure 3.9.4-1). Ephemeral streams in the lower portions of Ancho and Chaquehui Canyons extend to the Rio Grande without being depleted. In lower Water Canyon, the ephemeral stream is very short and does not extend to the Rio Grande. In Pajarito Canyon, Homestead Spring feeds an ephemeral stream 3.2- to 4.8-km (2- to 3-mi) long.

Springs between 2,408- and 2,713-m (7,900- and 8,900-ft) elevation on the eastern slope of the Jemez Mountains supply base flow throughout the year to the upper reaches of Cañon de Valle, Los Alamos, Pajarito, and Water Canyons. These springs discharge water perched in the Bandelier Tuff and Tschicoma Formation at rates from 0.0001 to 0.0085 m³/s (0.0035 to 0.30 ft³/s). The volume of flow from the springs is insufficient to maintain surface flow within more than the western third of the canyons before it is depleted by evaporation, transpiration, and infiltration (DOE 1995hh:4-26).

Eleven drainage areas, with a total area of 212 km² (82 mi²) pass through the eastern boundary of LANL. Runoff from heavy thunderstorms and heavy snowmelt reaches the Rio Grande several times a year from some drainages. Los Alamos, Pajarito, and Water Canyons have drainage areas greater than 26 km² (10 mi²). Pueblo Canyon has a drainage area of 21 km² (8 mi²), while all others have less than 13 km² (5 mi²). The overall flood risk to LANL is low because nearly all the structures are located on the mesa tops, from which runoff drains rapidly into the deep canyons (DOE 1995hh:4-76). No surface water is withdrawn at LANL for either drinking water or facility operations (DOE 1993j:4-76).

Los Alamos, Sandia, and Mortandad Canyons currently receive treated industrial or sanitary effluent. Pueblo Canyon does not receive LANL effluents. Surface waters in these canyons are not a source of municipal, industrial, or agricultural water supply. Several times during the year heavy precipitation or snowmelt would cause waters from several canyons to extend beyond LANL boundaries and reach the Rio Grande (LANL 1995s:II-7).

In Mortandad Canyon, no surface runoff to LANL's boundary has occurred since studies were initiated in 1960. Pueblo Canyon received both untreated and treated industrial effluents from 1944 to 1964. It currently receives treated sanitary effluents from Los Alamos County treatment plants in its upper and middle reaches (DOE 1993j:4-76).

Existing wastewater generation from LANL is approximately 693 million l/yr (183 million gal/yr) (DOE 1993j:4-76). Permitted effluent discharges at LANL emerge from 2 sanitary wastewater treatment facilities and 130 industrial outfalls. These outfalls include power plant discharges (1 outfall), boiler blowdown (2 outfalls), treated cooling water (38 outfalls), noncontact cooling wastewater (51 outfalls), radioactive waste treatment plant (1 outfall), HE wastewater (21 outfalls), photographic laboratory rinse wastewater (13 outfalls), printed circuit board process wastewater (1 outfall), and sanitary wastewater (2 outfalls) (LANL 1995s:D-3).

Surface Water Quality. The 1993 surface water quality monitoring results for the five onsite canyons are presented in Table 3.9.4-1. The overall compliance for sanitary and industrial discharges during 1993 was 100 percent and 99.1 percent, respectively.

Water Rights and Permits. Water rights in New Mexico fall under the Doctrine of Prior Appropriations. Under this doctrine, the user who first appropriated water for a beneficial use has priority to use available water supply

Table 3.9.4-1. Summary of Surface Water Quality Monitoring at Los Alamos National Laboratory, 1993

Parameter	Unit of Measure	Water Quality Criteria and Standards ^a	Pajarito Canyon ^b	Pueblo Canyon ^c	Los Alamos Canyon ^d	Sandia Canyon ^e	Mortandad Canyon ^f
Bicarbonate	mg/l	NA	68	141	138	146	138
Calcium	mg/l	NA	28	.15	36	22	38
Carbonate	mg/l	NA	<5	<5	<5	<5	<5
Cesium-137	pCi/l	120 ^g	1.0±1.5	2.3±1.3	3.0±1.3	3.0±1.2	NA
Chloride	mg/l	250 ^h	58	34	111	70	9
Fluoride	mg/l	4.0 ⁱ , 2.0 ^h	0.1	0.4	0.7	0.9	0.6
Magnesium	mg/l	NA	7.1	2.6	2.5	4.6	3.5
Nitrate	mg/l	10.0 ^j	0.04	4.53	<0.04	2.8	18
pH	pH units	6.8-8.5 ^h	7.9	7.3	7.8	8.6	8.2
Phosphate	mg/l	NA	0	5.3	0.1	2.5	0.6
Plutonium-238	pCi/l	1.6 ^g	-0.005±0.042	-	-0.036±0.030	0.004±0.030	748±0.058
Plutonium-239/240	pCi/l	1.2 ^g	0.006±0.028	0.019±0.030	0.118±0.024	0.012±0.020	493±0.046
Potassium	mg/l	NA	5	N/A	7	N/A	5
Sodium	mg/l	NA	28	40	87	110	60
Strontium-90	pCi/l	400 ^g	0±0.7	2.2±0.7	0±0	1.0±0.9	33.7±2.2
Sulfate	mg/l	250 ^h	13	23	12	100	9
Total dissolved solids	mg/l	500 ^h	228	404	356	558	302
Total hardness as CaCO ₃	mg/l	NA	106	55	104	72	110
Tritium	pCi/l	80,000 ^g	600±400	600±300	800±300	600±300	13,100±1,100
Uranium, Total	mg/l	0.02 ^j	<0.2±0	<1.0±0	<1.0±0	<1.0±0	N/A

^a For comparison purposes only.

^b Mean of multiple samples.

^c Surface water is monitored at two locations in Pueblo Canyon. The monitoring results presented are from Pueblo 3.

^d Two locations are normally monitored in Los Alamos Canyon; however, one location was dry at the time of sampling. Results are reported for location DPS-1.

^e Three locations are monitored in Sandia Canyon. The monitoring results presented are from the sampling location with the highest concentration of the given parameter.

^f Only one location in Mortandad Canyon is sampled (GS-1).

^g DOE DCG for drinking water (DOE Order 5400.5). Values are based on a committed effective dose of 100 mrem per year. However, because the drinking water maximum contaminant level is based on 4 mrem per year, the number listed is 4 percent of the DCG. All concentrations of radionuclides are determined by subtracting the instrument background environmental level from the monitored concentrations. A negative or zero incremental concentration means that the concentration at the sampling location is equivalent to the environmental level.

^h National Secondary Drinking Water Regulations (40 CFR 143).

ⁱ National Primary Drinking Water Regulations (40 CFR 141).

^j Proposed National Primary Drinking Water Regulation, Radionuclides (56 FR 33050).

Note: NA=not applicable; N/A=not analyzed.

Source: LANL 1995s.

over a user claiming rights at a later time. All natural water flowing in streams and water courses in New Mexico is considered to be public and subject to appropriation for beneficial use. Beneficial use is the basis, measure, and limit of the right to use water. No water right, therefore, may be granted or claimed for more than the amount that can be beneficially used. DOE owns combined surface and groundwater rights. These rights include the withdrawal of 6,835 million l/yr (1,806 million gal/yr) from a variety of wells and surface diversions under licenses RG-485 through RG-488, 1503, 1802, and 1802-B. DOE also owns a contract for 1,480 million l/yr (391 million gal/yr) of San Juan/Chama Diversion water.

Groundwater. Groundwater in the LANL area exists in three modes—in shallow alluvium in canyons, perched groundwater, and in the main aquifer. The main aquifer consists mostly of clastic sediments within the Santa Fe Group and the Puye Formation. Nearly all groundwater at LANL is obtained from deep wells that produce water from this aquifer. A minor amount of groundwater at LANL is obtained from springs. Most aquifers that lie beneath LANL, with the exception of perched zones, are considered Class II aquifers, having current sources of drinking water and other beneficial uses (DOE 1993j:4-77).

The Santa Fe Group consists of, in ascending order, the Tesuque Formation, Puye Conglomerate, and basaltic rocks of Chino Mesa. The Tesuque Formation contains thin, jointed, interbedded basalt flows that may yield large amounts of water. Some units have lower permeabilities that restrict the movement of water within the formation. The Puye Conglomerate overlies the Tesuque Formation and is highly permeable. When saturated, it yields large amounts of water to wells (LANL 1984a:3).

The depth to the top of the aquifer ranges from about 366 m (1,200 ft) on the west to about 183 m (600 ft) on the east. The total saturated thickness penetrated by production wells ranges up to approximately 518 m (1,700 ft). The most productive area lies in the central portion of the Pajarito Plateau and includes the Pajarito well field. The average drawdown for these wells is 12 m (39.4 ft). The rate of movement of water in the aquifer is approximately 12 to 29 m (39.4 to 95.1 ft) per year (LANL 1984a:7,8).

Groundwater Quality. Most of the wells in the Pajarito Plateau yield fresh water (TDSs less than 500 milligrams [mg]/l or parts per million [ppm]), although some wells east of the site have a higher total dissolved solids content (1,000 mg/l or more). The primary, secondary, and radiochemical groundwater quality, as measured from wells and springs in the main aquifer were below the DOE derived concentration guides or the New Mexico standards applicable to a DOE drinking water system (DOE 1993j:4-77). As shown in Table 3.9.4-2, parameters were below the applicable water quality criteria or standard in the main aquifer in 1993.

Groundwater Availability, Use and Rights. The LANL, the nearby communities of Los Alamos and White Rock, and Bandelier National Monument are entirely dependent on groundwater for their water supply. The water supply is primarily obtained from well fields. During 1993, total production from the wells for potable and nonpotable use was 5,519 million l/yr (1,458 million gal/yr) (LANL 1995r:4). LANL's water system had an average demand equal to about 81 percent of its current allotment of 6,800 million l/yr (1,800 million gal/yr).

Two wells have been drilled recently at LANL, one of which began pumping in the summer of 1992. The newer wells are expected to supplant the now abandoned Los Alamos field. Water is taken from depths of 245 to 550 m (804 to 1,805 ft).

Over the next 50 years, increases in water use may require one of the following: use of the 1,500 million l/yr (396 million gal/yr) San Juan-Chama water (releasing the water in exchange for excess pumping) and/or establishment of credit for return flow (DOE 1993j:4-79).

Table 3.9.4-2. Groundwater Quality Monitoring at Los Alamos National Laboratory, 1993

Parameter	Unit of Measure	Water Quality Criteria and Standards ^b	1993 Existing Conditions ^a			
			Test Well DT-9	Test Well DT-5A	Water Supply Well PM-5	Water Supply Well PM-2
Cesium-137	pCi/L	120 ^c	2.1 (1.2)	2.3 (1.4)	0.2 (0.5)	1.4 (1.2)
Chloride	mg/L	250 ^{d,e}	2	2	4	2
Fluoride	mg/L	2.0 ^e , 4.0 ^f	0.3	0.3	0.3	0.2
Nitrate	mg/L	10 ^f	0.32	0.44	0.10	<0.04
pH	pH units	6.8-8.5 ^e	8.2	8.0	7.6	8.2
Plutonium-238	pCi/L	1.6 ^c	-0.014(0.030)	-0.014 (0.030)	<0.1 (0)	0.004 (0.030)
Plutonium-239/240	pCi/L	1.2 ^c	0.008 (0.030)	0.032 (0.030)	0.03 (0.03)	0.127 (0.024)
Sulfate	mg/L	250 ^d	3	3	3	4
Total dissolved solids	mg/L	500 ^d	112	104	320	136
Tritium	pCi/L	80,000 ^c	300 (300)	400 (300)	400 (300)	500 (300)
Uranium, Total	mg/L	0.02 ^g	<2.0 (0)	<2.0 (0)	<1.0 (0)	<1.0 (0)

^a All data come from groundwater from onsite stations. Samples were collected in 1993.

^b For comparison purposes only.

^c DOE DCG for drinking water (DOE Order 5400.5). Values are based on a committed effective dose of 100 mrem per year. However, because the drinking water maximum contaminant level is based on 4 mrem per year, the number listed is 4 percent of the DCG. All concentrations of radionuclides are determined by subtracting the instrument background environmental levels from the monitored concentrations. A negative or zero incremental concentration means that the concentration at the sampling location is equivalent to the environmental level.

^d New Mexico State water quality criteria.

^e National Secondary Drinking Water Regulations (40 CFR 143).

^f National Primary Drinking Water Regulations (40 CFR 141).

^g Proposed National Drinking Water Regulations, Radionuclides (56 FR 33050).

Note: Well locations are shown in Figure 3.9.4-1; Parentheses indicate standard error of the mean.

Source: LANL 1995s.

Based on No Action projections, the net growth in overall use is about 0.4 percent per year. Based on this growth rate, the present allotment would be fully used by about 2052. If San Juan-Chama water is added, the limit to the total available supply would be reached by about 2072.

3.9.5 GEOLOGY AND SOILS

Geology. The LANL is located on the Pajarito Plateau, which lies between the Jemez Mountains on the west and the Rio Grande River on the east. The surface of the plateau slopes gently eastward and is dissected by deep, southwest-trending canyons separated by long, narrow mesas. The Pajarito Plateau terminates along its eastern edge along the Puye Escarpment and White Rock Canyon.

The primary controlling feature in the region is the Rio Grande rift that begins in Northern Mexico, trends northwest across central New Mexico, and ends in central Colorado. The rift comprises a series of basins formed by faulting that are filled with sediments derived from highlands to the east and west as well as occasional lake deposits and lava flows. The rift basin in the Los Alamos and Santa Fe area is the Española Basin.

The Pajarito Plateau is capped by the Bandelier Tuff, which consists of a series of ash fall and ash flow tuff (LANL 1984a:6). The major portion of LANL is underlain by the Tshirege member of the Bandelier Tuff, a sequence of cliff-forming welded ash flows with ash fall basal units. The Bandelier Tuff is underlain by sedimentary and volcanic rocks of the Santa Fe Group, which includes the Tesuque Formation, Puye Conglomerate, and basaltic rocks of Chino Mesa (LANL 1984a:3-7).

The LANL lies within Seismic Zone 2 (Figure 3.2.5-1). The strongest earthquake in the last 100 years within an 80-km (50-mi) radius was estimated to have a Richter magnitude of 5.5 to 6 and a MMI of VII. Studies suggest that several faults have produced seismic events with Richter magnitudes of 6.5 to 7.8 in the last 500,000 years (LANL 1987c:ix). LANL operates a seismic hazards program that monitors seismicity through a seismic network and conducts studies in paleoseismology.

The Pajarito Fault system, part of which crosses the western boundary of LANL, is a major, active structural element of the Rio Grande rift. Recent studies have determined that faults within the Pajarito Fault system are capable in accordance with 10 CFR 100, Appendix A (LANL 1987c:ix). Major faults at LANL include the Pajarito, Water Canyon, Rendija Canyon, and Guaje Mountain Faults (Figure 3.9.5-1). The Pajarito Fault is thought to mark the active western boundary of the Española Basin and has evidence of multiple movement in the past 100,000 to 200,000 years. The Rendija Canyon and Guaje Mountain Faults are shorter and secondary to the Pajarito Fault and had movement approximately 8,000 to 9,000 years ago and 4,000 to 6,000 years ago, respectively (DOE 1995hh:4-19).

The 100-year earthquake at Los Alamos is regarded as having a Richter magnitude of 5, with an event of Richter magnitude 7 being the maximum credible earthquake. These values are currently used in design considerations at LANL (LANL 1987c:43,53,54,58).

Geological concerns associated with the LANL area include potential downslope movements in association with regional seismic activity. Although isolated rockfalls commonly occur from the canyon rims, landslides are an unlikely hazard at Los Alamos because of the dry climate, deep water table, and rock characteristics. Although the area has the potential for future volcanic eruptions, the periodicity and structural development of past eruptions indicate a very low probability of an event occurring within the next 1,000 years (LA DOE 1979a:3-17).

Soils. The LANL is underlain by soil types varying in texture from clay and clay loam to gravel. Over 95 percent of the soils are developed on acidic volcanic rocks (LANL 1978a:6,7). Because of the topographic relief of the Pajarito Plateau, rock outcrops occur on greater than 50 percent of the site area.

Water and wind erosion of these soils varies from slight to severe depending on slope, soil grain size, amount of disturbance, and degree of protection. Shrink-swell potential ranges from low to high, correlating with the amount of swelling clays present (LANL 1978a:80). The soils are acceptable for standard construction techniques.

3.9.6 BIOLOGICAL RESOURCES

Terrestrial Resources. The LANL lies within the Colorado Plateau Province. Ecosystems within the laboratory site itself are quite diverse due partly to the 1,500-m (5,000-ft) elevational gradient from the Rio Grande River on the southeastern boundary to the Jemez Mountains, 20 km (12.4 mi) to the west, and to the many canyons with abrupt slope changes that dissect the site. Only a small portion of the total land area at LANL has been developed. The remaining land has been classified into seven major vegetative communities as shown in Figure 3.9.6-1.

Within LANL, the predominant community types are juniper grassland in the eastern one-third, pinyon-juniper in the central one-third, and ponderosa pine in the western one-third. The juniper-grassland community is found along the Rio Grande on the eastern border of the Pajarito Plateau and extends upward on the south-facing sides of the canyons at 1,700 to 1,900 m (5,600 to 6,200 ft). The pinyon-juniper community, generally found in the 1,900- to 2,100-m (6,200- to 6,900-ft) elevation range, includes large portions of the mesa tops and north-facing slopes at the lower elevations. The ponderosa pine community is found in the western portion of the plateau and on mesa tops in the 2,100- to 2,300-m (6,900- to 7,500-ft) elevation range. Coniferous trees are the dominant vegetation in the LANL environs, with pinyon pine and one-seed juniper predominate below 2,100 m (6,900 ft), and ponderosa pine and Douglas fir predominate above that elevation (DOE 1995hh:4-39-4-42). Almost 350 vascular plant species have been found, or are likely to be found, on LANL (LA DOE 1979a:3-39).

Terrestrial animal species that can be found on or near LANL include 1 amphibian, 9 reptile, 189 bird, and 45 mammal species (LA DOE 1979a:3-46, C-1-C-3). Undeveloped areas within LANL provide habitat for a diversity of terrestrial wildlife. Species lists have been compiled from observational data and published data, but the occurrence of some species has not been verified (DOE 1995hh:4-42). Among vertebrates, the collared lizard, eastern fence lizard, and whiptail lizard are some of the reptiles found at LANL. Typically, these are found at elevations between 1,910 and 2,134 m (6,265 and 7,000 ft). Bird species that nest in the area include the Mexican spotted owl, great-horned owl, and red-tailed hawk among the raptors, and Say's phoebe, lesser goldfinch, and American robin among other types. Overwintering species include the scrub jay, common raven, and house finch (DOE 1995hh:4-42). Migratory birds and their nests and eggs are protected by the *Migratory Bird Treaty Act*. Eagles are similarly protected by the *Bald and Golden Eagle Protection Act*.

Some of the larger mammals at LANL are the black bear, coyote, and raccoon, while the smaller species include the Mexican woodrat, deer mouse, Abert's squirrel, and mountain cottontail (DOE 1995hh:4-42). The most important and prevalent big game species at LANL are mule deer and elk. LANL lands have traditionally been a transitional area for wintering elk and mule deer. More recently, these two species have been using LANL property on a year-round basis.

Throughout LANL's history, developments within various TAs have caused significant alterations in the terrain and the general landscape of the Pajarito Plateau. These alterations have resulted in significant changes in land use by most groups of wildlife species, particularly birds and larger mammals that have large seasonal and/or daily ranges. Certain projects required the segregation of large areas such as mesa tops, and, in some cases, project areas were secured by virtually impenetrable fences around their perimeters. These alterations have undoubtedly caused some species of wildlife, such as elk and deer, to alter their land-use patterns by cutting off or altering seasonal or daily travel corridors to wintering areas, breeding habitats, foraging habitats, and bedding areas, as well as other necessary habitats.

In 1980, elk were primarily using the southwestern portion of LANL. In addition, critical calving areas and important high-use areas were identified, all of which were primarily in the west and southwest part of LANL. Since 1980, the number of elk using LANL lands increased significantly. Studies of elk conducted from 1991 to 1993 revealed increased use of habitats north and northeast of previously documented high-use areas. There have also been recent concerns about increases in motor vehicle accidents involving elk and deer in the LANL

area. In general, however, little is known of habitat use patterns, population trends, and characteristics of elk on the Pajarito Plateau (DOE 1995hh:4-43).

Wetlands. National Wetland Inventory maps show that most LANL wetlands occur in canyons that drain to the Rio Grande River. Wetlands are found in most of the canyons on the laboratory site including Pueblo, Los Alamos, Sandia, Mortendad, Pajarito, Water, Ancho, Chaquchi, and White Rock (Rio Grande) Canyons. Wetlands have also developed in the vicinity of outfalls from LANL facilities. Most wetlands are classified as riverine intermittent, meaning they may contain flowing water part of the year and may contain pooled water or be dry the remainder of the year. Palustrine emergent and/or scrub-shrub wetlands are also indicated in sections of Pueblo, Los Alamos, Sandia, Pajarito, and Ancho Canyons. Most of the riverine and palustrine wetlands known to exist at LANL are designated as temporary or seasonal by the NWI maps.

Aquatic Resources. Aquatic habitats at LANL are limited to the Rio Grande and several springs and intermittent streams in the canyons. Some of these habitats currently receive NPDES-permitted wastewater discharges. The springs and streams at LANL do not support fish; however, many other aquatic species thrive in these waters (DOE 1995hh:4-43).

The Rio Grande is located along the southeastern property boundary and supports populations of common carp, chub, white sucker, and carpsucker. Game fish inhabiting the Rio Grande River in the vicinity of LANL include the channel catfish and brown trout (LANL 1992a:3).

Threatened and Endangered Species. Twenty federally or State-listed threatened, endangered, and other special status species may be found on and in the vicinity of LANL (Table 3.9.6-1). Four of these species have been observed on LANL. The federally listed species recorded onsite include the Mexican spotted owl, which has recently been observed nesting near TA-15 (two young were fledged from this nest during the 1995 breeding season) (DOE 1995hh:4-45), the bald eagle, which winters along the Rio Grande River, and peregrine falcon, which historically nested onsite and occasionally still forages there. The State-threatened Jemez Mountain salamander has also been observed onsite. LANL canyons provide suitable nesting, roosting, and foraging habitats for the Mexican spotted owl. No critical habitat for threatened or endangered species, as defined in ESA (50 CFR 17.11; 50 CFR 17.12), exists on LANL; however, critical habitat for the Mexican spotted owl has been designated in areas bordering the northern and western boundaries of LANL (60 FR 29914).

Table 3.9.6–1. Federally and State-Listed Threatened, Endangered, and Other Special Status Species That May Be Found on or in the Vicinity of Los Alamos National Laboratory

Common Name	Scientific Name	Status ^a	
		Federal	State
Mammals			
New Mexican meadow jumping mouse	<i>Zapus hudsonius luteus</i>	NL	T
Spotted bat	<i>Euderma maculatum</i>	NL	T
Birds			
Baird's sparrow	<i>Ammodramus bairdii</i>	NL	T
Bald eagle ^{b,c}	<i>Haliaeetus leucocephalus</i>	T	T
Broad-billed hummingbird	<i>Cynanthus latirostris</i>	NL	T
Common black-hawk	<i>Beuteogallus anthracinus</i>	NL	T
Gray vireo	<i>Vireo vicinior</i>	NL	T
Mexican spotted owl ^c	<i>Strix occidentalis lucida</i>	T	NL
Peregrine falcon ^{b,c}	<i>Falcon peregrinus</i>	E (S/A)	E
Southwestern willow flycatcher	<i>Empidonax traillii extimus</i>	E	T
Whooping crane ^b	<i>Grus americana</i>	E	E
Amphibians			
Jemez Mountain salamander ^c	<i>Plethodon neomexicanus</i>	NL	T
Fish			
Rio Grande silvery minnow	<i>Hybognathus amarus</i>	E	T
Invertebrates			
Say's pond snail	<i>Lymnaea caperata</i>	NL	E
Plants			
Checker lily	<i>Fritillaria atropurpurea</i>	NL	R
Giant helleborine orchid	<i>Epipactis gigantea</i>	NL	RS
Golden lady's slipper	<i>Cypripedium pubescens</i>	NL	E
Sandia alumroot	<i>Heuchera pulchella</i>	NL	RS
Santa Fe cholla	<i>Opuntia viridiflora</i>	NL	E
Wood lily	<i>Lilium philadelphicum</i> var. <i>andinum</i>	NL	E

^a Status codes: E=endangered; NL=not listed; R=State rare plant review list; RS=State rare and sensitive plant species; S/A=protected under the similarity of appearances provision of the *Endangered Species Act*; T=threatened.

^b USFWS Recovery Plan exists for this species.

^c Species recorded on LANL.

Source: 50 CFR 17.11; 50 CFR 17.12; DOE 1995hh; LANL 1996e:2; NM DGF 1990b; NM DGF 1995a; NM FRCD 1995a.

3.9.7 CULTURAL AND PALEONTOLOGICAL RESOURCES

Prehistoric Resources. Prehistoric site types identified in the vicinity of LANL include large multiroom pueblos, field houses, talus houses, shrines, rock shelters, animal traps, hunting blinds, water control features, agricultural fields and terraces, quarries, rock art, trails, campsites, windbreaks, rock rings, and limited activity sites. Approximately 75 percent of LANL has been inventoried for cultural resources. Coverage for many inventories has been less than 100 percent; however, approximately 60 percent of LANL has received 100-percent coverage. More than 1,300 prehistoric sites have been recorded at LANL, and approximately 95 percent of these sites are considered eligible or potentially eligible for the NRHP. Two areas in the vicinity of LANL have been established as NRHP sites or districts: Bandelier National Monument (named as a monument in 1916) and Puye Cliffs Historical Ruins.

Historic Resources. Historic resources consist of homesteads, corrals, ditches, trash scatters, roads and trails, railroads, ranches, mines, remains of commercial ventures, and buildings associated with the Manhattan Project and the Cold War era. More than 80 historic resources have been recorded at LANL, and about 90 percent of the resources are considered eligible or potentially eligible for the NRHP.

The existing LANL facilities have been extensively modified and refurbished since 1943 when major construction occurred after World War II. The existing facilities are not likely to be considered NRHP eligible because they lack architectural integrity and may not be representative of a particular style. However, some of the facilities may be NRHP eligible based on their association with the broad historic theme of the Manhattan Project and initial nuclear production.

Portions of a number of TAs have been surveyed. NRHP-status buildings exist in TAs -3, -8, -9, -16 (74 individual buildings); TA-22 (TA-22-1); TA-28; and TA-55. Structures at the front and back gates are also eligible for the NRHP. Additional NRHP-eligible historic resources may exist in other TAs.

Native American Resources. Native Americans in the area with concerns include the six Tewa-speaking Pueblos of the northern Rio Grande Valley (San Ildefonso, San Juan, Santa Clara, Nambe, Tesuque, and Pojoaque), and the Cochiti and Jemez Pueblos.

Cultural resources are of special importance to Native Americans. These resources located on the LANL site may consist of prehistoric sites with ceremonial features such as kivas, village shrines, petroglyphs, or burials, or traditional cultural properties with no observable manmade features. Consultations by DOE with local Native Americans to identify any such cultural resources have been conducted in the past and are ongoing. An ethnographic study is currently being conducted to identify traditional cultural properties in the area as part of a sitewide EIS for LANL.

Paleontological Resources. The Pajarito Plateau consists primarily of Pleistocene volcanic tuffs and compacted pumice and ashfalls of the Bandelier Formation. None of the formations within LANL are known to be fossiliferous.

3.9.8 SOCIOECONOMICS

Socioeconomic characteristics addressed at LANL include employment and regional economy, population and housing, community services, and local transportation. Statistics for employment and regional economy are presented for the REA that encompasses seven counties around LANL located in New Mexico (Table L.1-1). Statistics for population and housing, community services, and local transportation are presented for the ROI, a three-county area in which 88.1 percent of all LANL employees reside: Los Alamos County (48.3 percent), Rio Arriba County (20.8 percent), and Santa Fe County (19.0 percent) (Table L.1-9). More than half of the Los Alamos County employees reside in the unincorporated communities of Los Alamos and White Rock. In 1995, LANL employed 8,655 persons.

Regional Economy Characteristics. Selected employment and regional economy statistics for the LANL REA are summarized in Figure 3.9.8-1. Between 1980 and 1990, the civilian labor force in the REA increased 34.1 percent to the 1990 level of 100,300. The 1994 unemployment rate in the REA was 6.2 percent, which was about the same as the unemployment in New Mexico (6.3 percent). The region's per capita income of \$17,689 in 1993 was approximately 8.2 percent higher than New Mexico's per capita income of \$16,346.

As shown in Figure 3.9.8-1, the REA and New Mexico have similar employment patterns. The service sector accounts for the largest share of employment in both the region (31.2 percent) and in New Mexico (28.3 percent). Retail trade employment was approximately the same for the region (18.2 percent) and New Mexico (18.1 percent). Manufacturing employment accounted for 4.0 percent of the total regional employment but 5.8 percent of the total State employment.

Population and Housing. In 1994, the ROI population totaled 166,788. From 1980 to 1994, the ROI population grew by 36.6 percent, compared to 26.9 percent for New Mexico. Within the ROI, Santa Fe County experienced the largest increase at 48.6 percent. Population and housing trends are summarized in Figure 3.9.8-2. The unincorporated communities of Los Alamos and White Rock in Los Alamos County are included in the county population and housing analysis.

The 37.8-percent increase in the number of housing units between 1980 and 1990 for the ROI was much greater than the percent increase for New Mexico (24.5 percent). The total number of housing units for 1990 was 63,386. The 1990 homeowner vacancy rate in the ROI, 2.3 percent, was the same as New Mexico's homeowner vacancy rate. The rental vacancy rate for the ROI counties, 7.7 percent, was much less than New Mexico's rental vacancy rate (11.4 percent).

Community Services. Education, public safety, and health care characteristics were used to assess the level of community service in the LANL ROI. Figure 3.9.8-3 presents school district characteristics for the LANL ROI. Figure 3.9.8-4 presents public safety and health care characteristics.

Education. In 1994, seven school districts provided public education services and facilities in the LANL ROI. As shown in Figure 3.9.8-3, these school districts operated at between 57.4 percent (Chama Valley Independent School District) and 75.7 percent (Espanola Public School District) capacity. The average student-to-teacher ratio for the LANL ROI in 1994 was 17.3:1. The Espanola Public School District had the highest ratio at 18.9:1.

Public Safety. City, county, and State law enforcement agencies provided police protection to the residents in the ROI. In 1994, a total of 263 sworn police officers were serving the three-county ROI. The City of Santa Fe employed the greatest number of sworn police officers (104), while the City of Espanola had the highest officer-to-population ratios (2.5 sworn officers per 1,000 persons). The ROI average officer-to-population ratio was 1.6 officers per 1,000 persons. Figure 3.9.8-4 compares police force strengths across the ROI.

Fire protection services in the LANL ROI were provided by 800 paid and volunteer firefighters in 1995. The fire district with the highest firefighter-to-population ratio was located in Rio Arriba County, 10.2 firefighters per

1,000 persons, as indicated in Figure 3.9.8–4. Rio Arriba County employed the greatest number of firefighters (276). The average firefighter-to-population ratio in the ROI was 4.7 firefighters per 1,000 persons.

Health Care. There were four hospitals serving the three-county ROI in 1994. Figure 3.9.8–4 displays the hospital bed-to-population ratios for the LANL ROI counties. During 1994, all hospitals were operating at below capacity, with hospital occupancy rates ranging from 28.3 percent in Los Alamos County to 31.1 percent in Rio Arriba County.

In 1994, a total of 311 physicians served the ROI, with the majority (244) located in Santa Fe County. Figure 3.9.8–4 shows that the physician-to-population ratio for the ROI ranged from 0.6 per 1,000 persons in Rio Arriba County to 2.4 per 1,000 persons in Los Alamos County. The ROI average physician-to-population ratio was 1.9 physicians per 1,000 persons.

Local Transportation. Regional transportation routes provide access to LANL (see Figure 2.2.8–1 and Figure 2.2.8–2 for maps of regional and local roads near LANL). Interstate 25 provides access to Denver, CO, to the north and Albuquerque, NM, to the south. Interstate 40 and Interstate 25 intersect at Albuquerque, NM. Interstate 40 provides access to Amarillo, TX, to the east and Flagstaff, AZ, to the west. U.S. 285 meets Interstate 25 at Santa Fe. U.S. 285 is to the east of LANL.

Vehicular access to LANL is provided by New Mexico Route 502 to the east and New Mexico Route 4 to the west. New Mexico Route 502 intersects U.S. 285 at Pojoaque, New Mexico. New Mexico Route 4 intersects New Mexico Route 44 at San Ysidro.

There are no current or planned (within 1 to 2 years) road improvement projects that would affect access to LANL (NM DOT 1995a:1). There is no public bus service at LANL. There is a non-profit bus service between White Rock, LANL, and Los Alamos (LA DOE 1995a:1.)

The only major railroad in the ROI is the Burlington Northern and Santa Fe. A spur of this railroad extends to Santa Fe, NM, from the south. There are no navigable waterways within the ROI that are capable of accommodating waterborne transportation of material shipments to LANL. The Albuquerque International Airport provides passenger and cargo service in the ROI on national and international carriers (DOT 1992a:7-214–7-217). There are other smaller airports in the ROI.

3.10 DEEP BOREHOLE COMPLEX SITE (GENERIC)

Deep borehole-like waste storage facilities currently do not exist in the United States, and no actual sites for drilling a deep borehole have been proposed. Therefore, the approach to describing the environmental setting for the deep borehole is to provide a range of existing or probable environmental conditions. These conditions, to the extent possible, are determined from existing information about typical locations at either end of the range of conditions. It is assumed that these conditions, at either end of the range adequately represent the actual range of conditions. In developing a generic environmental baseline for the deep borehole site, a set of assumptions was used to help define where such a facility could be developed. The major assumptions were the following: (1) the site would be located within the contiguous United States in geologically stable Precambrian crystalline rocks; (2) the site would be located distant from international borders and any population centers; (3) the site would have reasonable access to water supplies, electrical power, and ground transportation; and (4) the site would be located so that surface waters could be sufficiently protected from construction activities and facility operations.

The optimum geographic location for a deep borehole site is an area far removed from major drainage, lakes, oceans, and areas of low population density. The topographic relief is minimal in order to provide a low differential head in groundwater. The area in the immediate vicinity of the deep borehole site is large enough to accommodate several drill sites, as previously described in Section 2.4.3, while avoiding steep surface water drainage gradients that would allow rapid distribution of contaminants in case of an accident.

The long-term performance of the deep borehole system depends primarily on the geologic system. Therefore, the most important factor that must be considered in the selection of an optimum borehole site is hydrologic isolation from the biosphere for geologic times. To achieve this degree of hydrologic isolation, the host rock must have very low matrix permeability. In addition, the locality should be in an area of low seismicity to indicate stable geology, where a possible return of glacial or pluvial climate will not cause a significant change in surface water or groundwater systems, and where there is no danger of exhumation by erosion.

An example of the low or completely undeveloped end of the range of existing conditions could be forests, grazing lands, agricultural areas, or federally owned land with almost no permanent facilities. Given the proper geologic and hydrologic conditions, and access to the transportation infrastructure, these types of areas could represent the undeveloped site in the range of environmental settings. Other locations that could be selected for a borehole site could be located in more developed areas. At the developed end of the range of environmental settings, a deep borehole site could resemble any one of the DOE sites previously described.

| Should this alternative be selected, a siting study would be conducted, in addition to identifying site-specific environmental conditions and impacts in a tiered NEPA document.

3.10.1 LAND RESOURCES

The approach to defining the environmental setting for land resources is not site-specific. Consequently, a range of land-use and visual resources conditions that could exist at potential deep borehole complex site locations has been provided (see Table 3.10.1-1).

Table 3.10.1-1. Land Resources Attributes of the Generic Deep Borehole Complex Site

Land Use Attributes	
Land Area	2,000 - 20,000 ha
Land Ownership	Public or private
Existing Land Use	
Onsite	Undeveloped agricultural or industrial
Offsite	Undeveloped and/or agricultural
Land Use Compatibility	Likely
Plans, Policies, and Controls	
Jurisdiction	Federal, State, local
Enforcement	Lax to stringent
Conformance	Site-dependent
Visual Resource Attributes	
Landscape Character	
Site	Gentle relief
Viewshed	Undeveloped to agricultural
Visual Resource	
Sensitivity Level	Low to medium to high
Distance zones	Foreground, middleground, background, and seldom-seen
BLM VRM class	3 to 5
Degree of contrast	Weak to moderate

Source: LLNL 1996a.

Land Use. The potential site would require at least 2,000 ha (5,000 acres) of land area to accommodate the facility and buffer zone. The potential site could be located on public or private lands ranging up to 20,000 ha (49,420 acres). If the borehole site were located on privately-owned land, it would likely require the low to middle range of land area. If the site were located on publicly owned land (Federal, State, or local), the borehole could be part of a much larger site and could require the upper range of this land area. The range of site existing land uses would likely be undeveloped, agricultural, or industrial. Therefore, a change in site land use could occur. It is likely that land uses within the immediate vicinity of the site would range from undeveloped to agricultural (for example, cropland and grazing land) use. Due to the 1.6-km (1-mi) buffer zone surrounding the facility, it is likely that incompatibility, if any, with adjacent offsite land use would be minimized. Depending upon location, use, ownership, or management, the site could be subject to a variety of land-use plans, policies, and controls at the Federal, State, or local level. The existence and the stringency of these land-use plans, policies, and controls vary by jurisdiction. Regulations governing the type, density, and location of development are traditionally applied at the municipal (local) level through the comprehensive plan and its implementing mechanism, the zoning ordinance. Development of a privately owned site could require a change in the existing zoning classification. Development of a publicly owned site would likely conform to existing site development plans. If adjacent lands or lands that could be impacted by site development are designated as special status lands (for example, prime farmland, wild and scenic river, or wilderness study area), site development could be subject to additional controls.

Visual Resources. The complex would likely be constructed on a very small portion of the total site area. The immediate viewshed would likely range from undeveloped (for example, meadow and forest land) to agricultural lands. As discussed in Section 3.1.1, a visual resource inventory is comprised of three factors: scenic quality, distance zones, and sensitivity levels. Area sensitivity levels could range from low to high. Potential high visual sensitivity areas that could be impacted by the facilities include nearby public roadways, residential areas, and recreational/scenic areas with high user volumes. However, nearby public roadways predominately used by site workers could have a lower sensitivity level, while sensitivity levels would likely range from medium to high if nearby roads are traveled by the general public. The full range of distance zones could occur. Due to the mandatory 1.6-km (1-mi) buffer zone, it is probable that views of the facilities would predominately fall into the middleground zone. Therefore, it is likely that the degree of contrast would range from weak to moderate and that the overall visual character of the site would be consistent with a BLM VRM classification ranging from Class 3 to Class 5.

3.10.2 SITE INFRASTRUCTURE

Baseline Characteristics. The generic deep borehole site could have the baseline site infrastructure characteristics within the ranges shown in Table 3.10.2-1.

Table 3.10.2-1. Generic Deep Borehole Complex Site Baseline Characteristics

Characteristics	Site Availability
Transportation	
Roads (km)	0 to 60
Railroads (km)	0 to 20
Electrical	
Energy consumption (MWh/yr)	6,500 to 12,000
Peak load (MWe)	2 to 1,000
Fuel	
Natural gas (m ³ /yr)	0 to 5,000,000
Oil (million l/yr)	0 to 100
Coal (t/yr)	0 to 200,000
Steam (kg/hr)	0 to 150,000

Source: HF DOE 1990e; INEL 1993a:5; NTS 1993a:4; OR LMES 1996i; PX 1995a:1; PX DOE 1995d; PX DOE 1996b; SRS 1993a:3.

The generic deep borehole site would be expected to be mostly open vacant land with a few widely scattered facilities. Any existing facilities would not likely be useful for the functions required in the deep borehole complex, but could possibly coexist with the developed borehole site.

The transportation infrastructure could be nonexistent on the site or could be well developed. However, the site would have reasonable access to transportation nodes with some new construction of access roads and railroad lines. There would be no surface water transportation in the vicinity.

Electricity, telecommunications, and other utilities may be available to the generic deep borehole site before development of the site. These utilities could be connected to the site or generated at the site, depending on the offsite availability. It is expected that the nearest electric utility company would be able to provide the modest borehole electricity requirements with little effect on the utility or sub-regional power pool. Typical ranges of capabilities of sub-regional power pools are shown in Table 3.10.2-2.

Natural gas, diesel, liquid propane fuel, and coal would be available from local utilities or suppliers either by pipelines or surface transportation to the borehole site.

Table 3.10.2–2. Generic Deep Borehole Complex Site Sub-Regional Power Pool Electrical Summary

Characteristics	Energy Production
Type Fuel^a	
Coal	14 to 59%
Nuclear	0 to 39%
Hydro/geothermal	2 to 46%
Oil/gas	<1 to 32%
Other ^b	0 to 30%
Total Annual Production	107,607,000 to 272,155,000 MWh
Total Annual Load	104,621,000 to 293,262,000 MWh
Energy Exported Annually^c	-45,400,000 to 6,359,000 MWh
Generating Capacity	24,870 to 61,932 MWe
Peak Demand	20,578 to 57,028 MWe
Capacity Margin^d	4,064 to 13,655 MWe

^a Percentages do not total 100 percent due to rounding.

^b Includes power from both utility and nonutility sources.

^c Energy exported is not the difference of production and load due to pumped storage.

^d Capacity margin is the amount of generating capacity available to provide for scheduled maintenance, emergency outages, system operating requirements, and unforeseen electrical demand.

Source: NERC 1993a.

3.10.3 AIR QUALITY AND NOISE

Meteorology and Climatology. The meteorological and climatological conditions for the generic deep borehole site include the range of extremes in ambient temperature, windspeed and direction, and precipitation exhibited over the United States. A generic deep borehole site could exhibit a wide diversity of climatology. Therefore, no further description of meteorology and climatology has been provided with respect to a generic deep borehole site.

Ambient Air Quality. Ambient air quality conditions for the generic deep borehole site include a wide range of pollutants and conditions. Some areas do not yet meet the ambient standards for certain pollutants. Areas with air quality better than the NAAQS are designated as being in attainment; areas with worse air quality are designated as nonattainment areas. Nonattainment areas could be less desirable for a deep borehole site since more restrictive requirements would apply for pollutants for which the area is nonattaining.

Noise. Specific existing noise sources and characteristics of a generic deep borehole site cannot be described. However, it is expected that such a site would be essentially rural in character and would have typically low background sound levels. Typical DNL in the range 35 to 50 dBA (EPA 1974a:B-4) can be expected for such a rural location where noise sources may include wind, insect activity, aircraft, and agricultural activity. An area that is essentially uninhabited can be expected to have lower sound levels, with the major sources of noise possibly including an occasional airplane and natural physical phenomena such as wind, rain, and wildlife activities.

3.10.4 WATER RESOURCES

Surface Water. Availability of water is location-specific and depends on the hydrology and constraints of the local area. The availability of water supplies can be characterized by precipitation. In areas where rainfall is abundant and population is dense, water supply is commonly obtained from local surface water reservoirs and shallow wells. In arid climates, water supply is commonly obtained from deep wells and manmade lakes created by damming major rivers. In humid climates, water supply is generally derived from surface water taken from major waterways. Local constraints include seasonal fluctuations in precipitation, with drought being an extreme example; consumption by other facilities using the same water supply; and State regulations, such as water appropriation permit requirements.

Water required for construction and operation activities may not be available to the generic deep borehole site before development of the site, depending on the site location. Water could be generated or delivered to the deep borehole site, either by pipelines or surface transportation, depending on the availability from offsite suppliers.

Surface water drainage areas could range in size from 0 to 3,200 km² (0 to 1,235 mi²). Surface water resources discharge rates could range from 0 to 3,360 m³/s (0 to 118,642 ft³/s). Surface water reservoir storage capacity could range from 0 to 49 trillion l (0 to 13 trillion gal).

Site drainage of the generic deep borehole site must comply with the regulations of the local governing agency. The minimum design level for the Storm Water Management System is the 25-year, 6-hour storm, but potential effects of larger storms up to the 100-year, 6-hour storm would also be considered for site evaluation.

In the vicinity of the generic deep borehole site, surface water classifications could range from none (no surface water near the site) to fresh water suitable for fishing, swimming, and other primary and secondary contact recreation, and also as an existing or potential source of potable water.

The deep borehole site would be located in an area above the critical flood elevation (as determined from maps and site studies) of the potential flood source (river, dam, levee, precipitation). The deep borehole site surface facilities would be located in an area where the lowest floor of the structure, including subsurface floors, would be above the level of the 500-year floodplains. All facilities, including their basements, would be sited in an area above the 100-year floodplain.

Surface Water Quality. The quality of surface water across the nation is very diverse, affected by both natural processes and human activities. The natural quality of surface water is determined largely by the quality of its primary groundwater source, which is affected by the types of rocks through which the water moves and by various chemical processes. Absorption of atmospheric gases and assimilation of runoff and direct discharges further account for water quality differences throughout various potential generic deep borehole sites.

The range of surface water quality conditions that would be found at a generic deep borehole site is presented in Table 3.10.4–1. The amount of dissolved minerals in water (measured as dissolved solids) is a general indicator of overall inorganic water quality and, as shown in the table, could range from 10 to 174 mg/l (10 to 174 ppm). Iron and manganese could exceed water quality criteria. Nitrogen and phosphorus, which are major nutrients, contribute to the eutrophication of streams and lakes. Eutrophic waters are rich in nutrients that cause excessive growth of aquatic plants (for example, algae). Several forms of nitrogen are found in natural waters. Most common are the nitrate, nitrite, and ammonia ions. As shown in Table 3.10.4–1, nitrogen concentrations could range from 0 to approximately 2 mg/l (0 to 2 ppm), and phosphorus concentrations could range from 0 to 0.29 mg/l (0 to 0.29 ppm). The upper limits are more common in areas where there is considerable farming and soils are more likely to erode.

Table 3.10.4-1. Summary of Typical Surface Water Quality at the Generic Deep Borehole Complex Site

Parameter	Unit of Measure	Water Quality Criteria and Standards ^a	Water Body Concentration	
			High	Low
Alkalinity	mg/l	NA	140	0
Alpha (gross)	pCi/l	15 ^b	1.3	<0.4
Ammonia	mg/l	NA	0.25	0
Beta (gross)	pCi/l	50 ^c	4.5	0.5
Calcium	mg/l	NA	9.9	0.8
Chloride	mg/l	250 ^d	3.54	0.2
Chromium	mg/l	0.1 ^b	0.04	0
Conductivity	µmhos/cm	NA	340	30
Dissolved oxygen	mg/l	>5.0 ^e	14	6
Iron	mg/l	0.3 ^d	1.5	0.02
Lead	mg/l	0.015 ^b	0.013	0
Magnesium	mg/l	NA	9.3	0.5
Manganese	mg/l	0.05 ^d	0.06	0
Nitrogen (as NO ₂ /NO ₃)	mg/l	NA	2.13	0
pH	pH units	6.5-8.5 ^d	8.5	6.3
Phosphorus	mg/l	NA	0.29	0
Sodium	mg/l	NA	20	0.7
Strontium-90	pCi/l	400 ^f	0.33	0.01
Suspended solids	mg/l	NA	67	1
Temperature	°C	NA	35	0
Total dissolved solids	mg/l	500 ^d	174	10
Uranium, Total	mg/l	0.02 ^c	0.00019	0.00017
Zinc	mg/l	5.0 ^d	0.6	0

^a For comparison only.^b National Primary Drinking Water Regulations (40 CFR 141).^c Proposed National Primary Drinking Water Regulations; Radionuclides (56 FR 33050).^d National Secondary Drinking Water Regulations (40 CFR 143).^e Varies with pH and temperature.^f DOE DCG for water (DOE Order 5400.5). Values are based on a committed effective dose equivalent of 100 mrem per year; however, because the drinking water maximum contaminant level is based on 4 mrem per year, the number listed is 4 percent of the DCG. [Text deleted.]

Note: NA=not applicable; µmhos/cm=micromhos per centimeter.

Source: DOD 1993a.

Surface Water Rights and Permits. Surface water rights concerning the water body closest to the deep borehole site could range from not being an issue (because the site does not withdraw or discharge to a surface water body, or asserts its federally reserved water withdrawal rights), to impairment of designated uses.

Discharge of a pollutant to surface water requires a permit under the NPDES. NPDES permits include effluent limitations specifying the maximum concentrations of specific pollutants that may be present in discharge water.

Groundwater. Because of their characteristic remoteness, many government facilities use groundwater from onsite wells for their primary water supply. Groundwater could be used alone during construction and operations or could be mixed with either surface water or treated reclaimed wastewater.

The proposed deep borehole site could also be located in an area with undeveloped groundwater reserves, in underlying geologic strata, that are capable of providing an adequate supply of good quality water. Site-specific hydrogeologic data would be required to evaluate the groundwater availability.

The near-surface aquifer beneath the generic deep borehole site could occur under confined to unconfined conditions. Depth to groundwater could range from 1 to 200 m (3.3 to 656 ft). Recharge could occur primarily from rainfall and surface water seepage. Common ranges of hydraulic characteristics of aquifers are presented in Table 3.10.4-2.

Table 3.10.4-2. Common Ranges of Hydraulic Characteristics of Aquifers

Characteristic	Range of Conditions	
	Low	High
Transmissivity (l per day/m)	46	46,200,000
Hydraulic conductivity (l per day/m ³)	0.0008	7,500
Recharge rate (cm/yr)	0.0025	50.8
Well yield (l/minute)	38	75,700

Source: DOD 1993a.

Aquifer classification beneath the generic deep borehole site could range from a sole-source, federally protected, or EPA Class I aquifer (an aquifer which is required to supply 50 percent or more of the drinking water for that area and for which there are no reasonable available alternative sources should the aquifer become contaminated) to a Class III aquifer (an aquifer not considered a potential source of drinking water and of limited beneficial use because the salinity is greater than 10,000 mg/l (greater than 10,000 ppm) or the groundwater is otherwise contaminated beyond levels that can be removed using reasonable methods of public water supply treatment). Most aquifers found at government-operated facilities are Class II aquifers, which are current or potential sources of drinking water.

Groundwater Quality. Groundwater quality of the near-surface aquifer in the generic site area could range from good to poor. Groundwater that would occur at the emplacement zone depth would be brine. Characteristics of this water are high salinity (indicative of long-term isolation from the biosphere), low carbonate concentrations, slightly basic and reducing geochemistry, and low thermal gradient.

Groundwater Availability, Use, and Rights. Groundwater availability could range from not an issue (because the site does not withdraw groundwater) to critical groundwater overdraft and low surface water availability relative to demand. Critical is defined as more than 1,893 million l/day (500 million gal/day) of overdraft (VDL 1990a:725). Overdraft of groundwater occurs when water is withdrawn from sources that cannot be renewed or is withdrawn more quickly than it can be recharged.

Groundwater rights for a generic deep borehole site could range from absolute ownership rule to appropriation. Under the absolute ownership rule, the owners of land overlying a groundwater resource are allowed to withdraw unlimited water from their wells for whatever purpose they choose. Under the appropriation doctrine, all water is declared to be public and subject to appropriation on the basis of the "first in time, first in right" principle and control of the well use is usually accomplished by permits.

3.10.5 GEOLOGY AND SOILS

Geology. The deep borehole site could be located in a variety of geologic settings within the contiguous United States, provided the primary deep borehole site criterium, isolation from the biosphere, can be maintained for geologic times. Two key conditions for isolation from the biosphere would be geologic stability and the very low hydraulic efficiency of potential conduits (fractures, faults) to prevent pathways for transport of disposed materials to the surface.

Possible geologic terrains could range from interior basins to stable continental crust. Surficial material could range from desert sands to glacial tills. Coastal margins, volcanic zones, and seismically active zones are, by definition, unstable and would not represent optimal locations for the deep borehole site. The topography of the deep borehole site would range from flat to hilly; areas of high relief could result in large hydraulic head differences and deep circulation. Table 3.10.5–1 illustrates some of the principal advantages and disadvantages associated with the different types of candidate geologic media.

Soils. The deep borehole site may be located in areas where the predominant soil types range from clays to sands. These soils can range from poorly- to well-drained soils. Soil erosion from past land uses, if any, can range from slight to severe. The soil erosion potential can range from slight to severe in those areas with slopes greater than 25 percent and which have been eroded in the past. Wind erosion potential can range from low to high. The soils shrink-swell potential can range from low to severe.

Table 3.10.5-1. Attributes of Different Types of Geologic Media

Medium Type	Advantages	Disadvantages	Analysis
Plutonic/Metamorphic "Basement" Rocks (for example, granite)	Salinity increases with depth; fewer fractures at depth; mechanically strong, impermeable matrix; occurs in sufficiently thick sections; many locations with large areal extent.	Limited data on conditions at depth, may be structurally complex.	No disqualifiers, potential host rock.
Tuffs (consolidated volcanic ash)	High compressive strength; high sorptivity.	Columnar joints; fractures and cavities, water may induce geochemical changes; limited geologically old occurrences (fails tectonic stability test); vertical section discontinuous; may have insufficient depth.	Not suitable due to tectonic instability and vertical discontinuity.
Rock salt (evaporite)	Isolated from aquifers; low interstitial water content; self-healing fractures due to plasticity.	Interbedded rock layers in bedded salt could act as fluid conduits, brine pockets could migrate; drilling difficulties due to plasticity; holes may close before emplacement due to plastic flow; may not be thick enough; not as old as basement rock implying less stability; mobile salt (domes) are unstable.	Probably not suitable for borehole due to unfavorable mechanical properties.
Anhydrite (evaporite)	Chemically stable; little interstitial water; hydration induced swelling may reduce permeability.	Brittle and easily fractured; not self-healing; massive swelling during hydration causes fractures and borehole instability; may not be thick enough; not as old as basement rocks implying less stability; limited areal extent.	Probably not suitable due to unfavorable mechanical properties.
Sedimentary rocks (shales)	Low interstitial permeability; high sorptivity.	Flows plastically under high stresses, may lead to borehole instability; highly fractured; not as old as basement rocks implying less stability; vertically discontinuous; may have conductive interbeds.	Probably not suitable due to vertical discontinuity and vertical fractures.
Mafic lavas (flood basalts)	Low matrix permeability; high compressive strength.	Limited occurrences, may imply tectonic instability; vertically discontinuous; interbeds may be efficient transport routes.	Probably not suitable due to vertical discontinuity and implied tectonic instability.
Unconsolidated sediments (alluvium)	Moderate to high sorptive capacity; effective radionuclide barriers.	Geologically very young implying instability; high potential for erosion or continued tectonic movements; may not be thick enough; may be too conductive.	Unsuitable due to young age and implied tectonic instability.

Source: LLNL 1996i:1.

3.10.6 BIOLOGICAL RESOURCES

Terrestrial and Aquatic Resources

The description of terrestrial and aquatic resources has been divided into natural habitats and migratory birds. In each case, an overview of these resources is given for the area within which the generic deep borehole site may be sited.

Natural Habitats. The following description characterizes the principal vegetation types that could be found at a potential deep borehole site and is based on *Fundamentals of Ecology* and *The Study of Plant Communities: An Introduction to Plant Ecology* (Odum 1971a:377-403; Oosting 1956a:269-377). The principal vegetation types are defined by their climax vegetation (vegetation that develops following an extended time without major disturbance), a useful method of describing terrestrial resources, since vegetation types are comprised of similar groupings of flora and fauna. Although these vegetative types are a terrestrial resource classification system, the discussion of each addresses characteristic aquatic resources in the same geographical area.

Most areas have been subjected to substantial human disturbance over the past centuries, even though vegetation types are characterized by their climax vegetation. These areas now largely support successional vegetation, which can include grasses and forbs, shrubs and saplings, or forest cover comprising species other than those of the climax vegetation. Each vegetation type displays its own characteristic patterns of succession. Additionally, the boundary between any two is often a blend of characteristics from both types. The following principal vegetation types could be found at a generic deep borehole site.

Northern Coniferous Forest. Northern coniferous forest is common across much of Canada and Alaska, but within the type of area being considered for a deep borehole complex occurs only in the northern New England States. Climate is severe, with a short growing season and moderate precipitation. The principal evergreen species present in this forest include red spruce and balsam fir, which often form dense canopies under which little understory vegetation can grow. Paper birch, poplar, and aspen are common deciduous trees on disturbed sites. Animals found in northern coniferous forests within New England include moose, beaver, porcupine, boreal chickadee, red-breasted nuthatch, a variety of warblers, ring-necked snake, smooth green snake, green frog, and spotted salamander. Reptiles and amphibians are not as common in this vegetation type as in those that occur in more southerly latitudes. Aquatic habitat includes streams and lakes; bogs also commonly occur in the northern coniferous forest.

Hemlock-Hardwood Forest. Hemlock-hardwood forest is found in the northeastern and north-central part of the type of area under consideration for a deep borehole complex. This region is typified by long, cold winters and a short growing season. Although this is a northern forest type, it occurs at higher elevations along the Appalachian Mountains as far south as northern Georgia. Important tree species include hemlock, white pine, basswood, American elm, white ash, and red oak. Hemlock-hardwood forests support a diversity of animals, including red squirrel, snowshoe hare, ruffed grouse, pine siskin, and red crossbill. Reptiles and amphibians are not as numerous in this community type as in more temperate areas. The common garter snake, painted turtle, and chorus frog are found in hemlock-hardwood forests. Fast-moving streams occur within mountainous portions of this vegetation type, while lakes are common within those portions of the region that were glaciated.

Deciduous Forest. Deciduous forest occurs in most of the eastern third of the type of area under consideration for a deep borehole complex and is characterized by a moist, temperate, seasonal climate. The canopy of a deciduous forest is typically dominated by two or three species of trees. Common trees include oak, hickory, beech, and maple. A patchy to well-developed understory tree layer is found, and shrubs are common. The deciduous forest supports a variety of animal life, including the white-footed mouse, eastern gray squirrel, raccoon, gray fox, whitetail deer, black bear, wood thrush, ovenbird, downy woodpecker, worm-eating warbler, rat snake, eastern ribbon snake, American toad, and green frog. Streams and rivers are abundant in deciduous forest and include a number of major river systems, such as the Ohio.

Grassland. Grassland occurs in much of the central portion of the area under consideration. The climate is characterized by pronounced seasonality with respect to rainfall and temperature. Climax vegetation is characterized by grasses and other herbaceous plants, because there is insufficient rainfall to support forest communities. Because of the naturally fertile, nearly level soil, much of this vegetation type has been converted to farmland for producing grains and providing pasture for cattle. Fauna of grassland communities include the black-tailed prairie dog, thirteen-lined ground squirrel, horned lark, ring-necked pheasant, greater prairie chicken, prairie kingsnake, rat snake, western box turtle, chorus frog, and Great Plains toad. Playa lakes to the south and prairie pot holes to the north are important habitats for waterfowl and a number of other species of wildlife. Perennial and intermittent streams and small lakes characterize the aquatic resources of this vegetation type.

Desert. Desert occurs in much of the southwestern and western portion of the type of area under consideration for a deep borehole complex and is characterized by a scarcity of rainfall (less than 25 cm [9.8 in]) or rainfall that is very unevenly distributed. Vegetation is sparse and consists mainly of shrubs and rapidly growing annuals. During the short periods of rainfall, a large number of grasses and forbs briefly appear. Although the environment is harsh, the desert supports a variety of fauna, including the bighorn sheep, mule deer, black-tailed jackrabbit, mountain lion, coyote, javelina, golden eagle, greater roadrunner, Gambel's quail, desert tortoise, and various species of lizards and snakes. Aquatic resources are generally limited to intermittent streams and washes.

Rocky Mountain Forest. Rocky Mountain forest encompasses a number of vegetation types due to changes in environmental factors with altitude. This results in the zonation of plant communities, reflecting rapid altitude changes over short distances. A single mountainous area can feature four or five vegetation zones within a change of elevation of several thousand meters. The flora and fauna of each zone are often similar to those previously described (such as desert, grassland, deciduous forest, and northern coniferous forest). However, the zones are not always continuous nor are they always all present. Near the northern limits of this complex, the lower zones run out and the upper zones are found at relatively low altitudes. Southward, all zones are found at successively higher altitudes. Diverse freshwater aquatic habitats and species are associated with this vegetation complex.

Migratory Birds. Migratory birds include both waterfowl and the numerous other birds (for example, passerine species) that travel between breeding and wintering grounds. These species are dependent on the presence of adequate habitat along their migratory routes to provide both resting and feeding areas. The importance of these species has been recognized by the passage of the *Migratory Bird Treaty Act*. This act seeks to prevent the killing of migratory birds and the destruction of their eggs and nests.

Waterfowl. The four migratory waterfowl flyways (Pacific, Central, Mississippi, and Atlantic) represent some of the traditional routes for fall and spring migration of certain North American migratory waterfowl such as geese, swans, and cranes. While the Central and Mississippi flyways are entirely within the type of area being considered for a deep borehole complex, the Pacific and Atlantic flyways are only partially within the site area. To maintain migratory waterfowl populations, an adequate amount of open space, open water, and wetlands is necessary for foraging and refuge during migration. Wetlands also provide important breeding habitat for migratory waterfowl. Major breeding areas occur in the northern portion of the deep borehole site area. During the winter months, waterfowl migrate to the southern United States and Central America, where they congregate in wetland regions.

Other Migratory Birds. The flyways discussed above are a simplified method of describing migration paths used by certain types of waterfowl. Many other species of migratory birds follow different north-south routes across the type of area being considered for a deep borehole complex, often changing their migration paths from one year to the next. Typically, smaller birds such as rails, flycatchers, most sparrows, warblers, vireos, thrushes, and shorebirds migrate at night. Day migrants include large and small birds such as gulls, pelicans, hawks, swallows, nighthawks, and swifts (FWS 1979a:20,21,61).

Wetlands

Although wetlands occur across the entire type of area being considered for a deep borehole complex, they are most prevalent in the mid-Atlantic, southeast, south-central, and north-central portions of the site area. Major types of wetlands occurring in the site area include tidal salt marshes, freshwater marshes, northern peatlands, shrub swamps, and riparian forested wetlands. Wetlands serve important functions, including maintaining water quality, controlling floodwaters, stabilizing shorelines, and providing animal habitat and recreational uses such as hunting and fishing. Wetlands are also important in providing habitat for aquatic organisms and migratory birds, as well as for threatened and endangered plants and animals. Since it is difficult to protect surface waters and wetlands during construction drilling operations necessary for a deep borehole, wetlands typically would be avoided during selection of potential borehole drilling sites.

Threatened and Endangered Species

Threatened and endangered species could be present in each of the principal vegetation types discussed above. Over 750 threatened and endangered species occur in the United States (FWS 1995a:1-35). Endangered plants and animals often rely on sensitive environments such as wetlands for habitat. Critical habitats, geographical areas that are considered essential to the conservation of a species and that could require special management considerations or protection, can be designated and protected under the ESA. Protection of threatened and endangered species and their habitat is important for maintaining biodiversity, which is essential for full ecological functioning.

3.10.7 CULTURAL AND PALEONTOLOGICAL RESOURCES

Prehistoric Resources. Prehistoric resources could be affected by the construction and operation of a deep borehole site. These resources may include objects, sites, or districts. Archaeological sites can include villages and campsites. Sites may yield artifacts such as stone tools and associated manufacturing debris and ceramic potsherds. Some sites may be eligible for inclusion on the NRHP.

Historic Resources. Historic resources that could be affected by construction and operation of a deep borehole site include subsurface remains of human occupation such as structural foundations of buildings, important paths or roads, and cemeteries. Some standing buildings such as commercial structures and residences may also be considered historic resources.

Native American Resources. Native American resources that could be affected by construction and operation of a deep borehole site may include sites, areas, and materials important to Native Americans for religious or heritage reasons. Sacred sites may include cemeteries, plant communities, mountains, paths, or geographical spaces that are socially identified and circumscribed. Some Native American groups could be affected and may need to be consulted if a specific site is chosen.

Paleontological Resources. Paleontological resources that could be affected by construction and operation may include fossil remains of extinct plants or animals, some rare. They can include poorly known fossil forms, well-preserved terrestrial vertebrates, unusual depositional contexts, assemblages that contain a variety of fossil forms, or deposits recovered from poorly studied regions or in unusual concentrations.

3.10.8 SOCIOECONOMICS

The generic deep borehole site could potentially affect the socioeconomic environment of an REA or an ROI. The characteristics of the REA, ROI, and communities are dependent upon geographic location. Employment and income in the economic area would be based upon industry interaction and linkages in the region. The anticipated residential distribution of project-related employees and their families would determine the ROI, and the ROI would contain all principal jurisdictions and school districts for community services likely to be affected by the proposed activity. Local transportation would consist of the existing principal road, air, and rail networks required to support the project activities.

Potential locations for a deep borehole have not been identified, so the affected environment cannot specifically be determined. The deep borehole complex would require a buffer zone of approximately 2,000 ha (4,900 acres). If the deep borehole complex were located in a largely uninhabited region, the majority of the workforce might choose to live in a more densely populated region and endure a longer commute to work. There is also the possibility of limited housing availability (and residential utilities), which could cause workers and their families to move to the more densely populated areas. It is also possible that the REA and the ROI could comprise uninhabited areas and small rural communities or contain different community types. The range of potential community types could be categorized as uninhabited regions, rural areas and small rural communities, and medium-size communities.

Uninhabited regions include unpopulated portions of the United States and Federal lands that have been set aside and are not developable. Economic activity in these regions is nonexistent. The primary issue is the availability and suitability of infrastructure and transportation networks to support the project activities.

Rural areas and small communities include areas or communities with populations of less than 50,000. These are small business centers that have a small workforce with little diversification of industries and employment. Public services, infrastructure, and transportation networks are generally limited, but capacities would vary with each location. These areas generally have small, specialized economies and relatively large basic sectors dependent on export activities.

Medium-size communities include areas with a city of at least 50,000 in population or an urbanized area of at least 50,000 with a total metropolitan population of 100,000. These communities usually operate as local or regional centers for economic activity. A local center usually has the largest community within a radius of approximately 80 km (50 mi); however, a larger regional or nationwide center is nearby for wholesaling, finance, and activities that do not involve the consumer directly. A regional center usually would be the largest community within a radius of 160 to 240 km (100 to 150 mi). The number of employment sectors is higher than in small communities, and economic relationships would exist between only a limited number of industries. Public services, transportation networks, and other infrastructures would tend to be more extensive than in smaller communities.

Communities of each category typically differ in terms of size and diversification. The vulnerability or susceptibility of a local community to changes in the economic base depends, in large part, on the strength of its economic base, as indicated by its number of employment sectors, its diversification of employment sectors, its pool of available labor, and its degree of inter-industry linkages. Inter-industry linkage is an economic relationship between two or more industries within the same market. A well developed network of mutually supporting diversified industries insulates a local economy from factors outside the region and contributes to a strong economic base. Communities with strong diversified economic bases are not affected by socioeconomic change as much as communities that have bases that rely on a single basic employment sector.

3.10.9 PUBLIC AND OCCUPATIONAL HEALTH AND SAFETY

Radiation Environment. Major sources and levels of background radiation exposure to individuals in the vicinity of a generic deep borehole site are shown in Table 3.10.9–1. Annual background radiation doses to individuals are expected to remain constant over time. The total dose is expected to change as the population size changes. Background radiation doses are unrelated to any site operations that may exist at a potential deep borehole site.

Table 3.10.9–1. Sources of Radiation Exposure to Individuals in the Vicinity, Unrelated to Operation at the Generic Deep Borehole Complex Site

Source	Effective Dose Equivalent (mrem/yr)
Natural Background Radiation^a	
Cosmic and cosmogenic radiation	27 to 39
External terrestrial radiation	28 to 59
Internal terrestrial radiation	39 to 40
Radon in homes (inhaled) ^b	200
Other Background Radiation^b	
Diagnostic x rays and nuclear medicine	53
Weapons test fallout	<1
Air travel	1
Consumer and industrial products	10
Total	359 to 403

^a Based on annual reports for illustrative sites and EPA 1981b.

^b NCRP 1987a.

Note: Value for radon is an average for the United States.

Releases of radionuclides to the environment from operations at generic deep borehole sites provide another source of radiation exposure to individuals in the vicinity of the sites. Types and quantities of radionuclides released from operations in 1993 at sites at developed locations that have current nuclear activities (refer to Sections 3.2.9 through 3.7.9), which could be typical of a generic deep borehole are listed in the 1993 annual environmental reports for those sites. The range of doses to the public resulting from these releases is presented in Table 3.10.9–2. The doses fall within radiological limits (DOE Order 5400.5) and are small in comparison to background radiation. The releases listed in the 1993 reports were used in the development of the reference environments (No Action) radiological releases and resulting impacts in the year 2005 (Sections 4.3.3.1.9 and 4.3.3.2.2.9). For the generic deep borehole site that is not developed and has no current nuclear activities, there would be no radionuclide releases or doses in the past. For these sites, the No Action releases and doses in the year 2005 are assumed to be zero.

Based on a risk estimator of 500 cancer deaths per 1 million person-rem to the public (Section M.2.1.2), the fatal cancer risk to the maximally exposed member of the public due to radiological releases from operations in 1993 at the generic deep borehole sites addressed in Sections 3.2.9 through 3.7.9 is estimated to range from 2.9×10^{-11} to 1.5×10^{-6} . That is, the estimated probability of this person dying of cancer at some point in the future from radiation exposure associated with 1 year of deep borehole site operations ranges from about 3 chances in 100 billion to less than 2 chances in 1 million. (Note that it takes several to many years from the time of exposure to radiation for a cancer to manifest itself.)

Table 3.10.9–2. Radiation Doses to the Public From Normal Operation at the Generic Deep Borehole Complex Site in 1993 (Committed Effective Dose Equivalent)

Members of the General Public	Atmospheric Releases		Liquid Releases		Total	
	Standard ^a	Actual	Standard ^a	Actual	Standard ^a	Actual
Maximally exposed individual (mrem)	10	5.8×10^{-5} to 1.4	4	0 to 0.60 ^b	100	5.8×10^{-5} to 3.0 ^c
Population within 80 km ^d (person-rem)	None	1.4×10^{-4} to 26	None	0 to 2.0	100	1.4×10^{-4} to 28
Average individual within 80 km ^e (mrem)	None	5.0×10^{-7} to 0.030	None	0 to 0.0023	None	5.0×10^{-7} to 0.032

^a The standards for individuals are given in DOE Order 5400.5. As discussed in that order the 10 mrem/yr limit from airborne emission is required by the CAA, the 4 mrem/yr limit is required by the SWDA, and the total dose of 100 mrem/yr is the limit from all pathways combined. The 100 person-rem value for the population is given in proposed 10 CFR 834 (58 FR 16268). If the potential total dose exceeds the value, it is required that the contractor operating the facility notify DOE.

^b These doses are mainly from drinking water and eating fish.

^c This total dose includes 1 mrem/yr from direct radiation exposure.

^d In 1993, this population ranged from 21,750 to 880,000.

^e Obtained by dividing the population dose by the number of people living within 80 km of the site.

Note: Data from annual environmental reports for those illustrative sites discussed in Sections 3.2.9 through 3.7.9; all of these sites have nuclear activities. For potential sites having no nuclear activities, the doses would be zero.

Based on the same risk estimator, a range of 7×10^{-8} to 0.013 excess fatal cancers is projected in the populations living within 80 km (50 mi) of these same illustrative sites from normal operations in 1993. To place these numbers into perspective, they can be compared with the numbers of fatal cancers expected in these populations from all causes. The 1990 mortality rate associated with cancer for the entire U.S. population was 0.2 percent per year (Almanac 1993a:839). Based on this mortality rate, the number of fatal cancers expected during 1993 from all causes ranged from 44 to 1,760 in the population living within 80 km (50 mi) of the borehole site. These numbers of expected fatal cancers are much higher than the estimated range of 7×10^{-8} to 0.013 of fatal cancers that could result from operations at generic deep borehole sites in 1993. The risks and numbers of expected fatal cancers from radiation from generic deep borehole sites that currently have no nuclear activities would be zero.

Site workers receive the same dose as the general public from background radiation, but they also receive an additional dose from working in the site facilities. Table 3.10.9–3 presents the range of the average worker, maximally exposed worker, and total cumulative worker dose to workers from operations in 1992 at a generic site at developed locations that presently have nuclear activities (Sections 3.2.9 through 3.7.9). These doses fall within radiological regulatory limits (10 CFR 835). Based on a risk estimator of 400 fatal cancers per 1 million person-rem among workers (Section M.2.1.2), the number of excess fatal cancers to workers from site operations in 1992 is estimated to range from 8.0×10^{-4} to 0.14. For generic deep borehole sites at undeveloped locations with no nuclear activities, the occupational radiological exposure would be zero.

A more detailed presentation of the radiation environment, including background exposures and radiological releases and doses, is presented in the 1993 annual environmental reports for the active DOE sites, representative of developed locations. The concentrations of radioactivity in various environmental media (that is, air, water, and soil) in the regions of the sites (onsite and offsite) are also presented in these reports (see Sections 3.2.9 through 3.7.9).

Chemical Environment. The background chemical environment important to human health consists of the atmosphere, which may contain hazardous chemicals that can be inhaled; drinking water, which may contain hazardous chemicals that can be ingested; and other environmental media with which people may come in contact (for example, surface waters during swimming and soil through direct contact or via the food pathway).

Table 3.10.9–3. Radiation Doses to Workers From Normal Operation at the Generic Deep Borehole Complex Site in 1992 (Committed Effective Dose Equivalent)

Occupational Personnel	Onsite Releases and Direct Radiation	
	Standard ^a	Actual
Average worker (mrem)	ALARA	2.6 to 27.3
Maximally exposed worker (mrem)	5,000	660 to 3,000
Total workers ^b (person-rem)	ALARA	2 to 350

^a DOE's goal is to maintain radiological exposure as low as reasonably achievable.

^b The number of badged workers in 1992 ranged from 780 to 19,500.

Source: 10 CFR 835; DOE 1993n:7.

The baseline data for assessing potential health impacts from the chemical environment are those presented in Sections 3.2.3 through 3.7.3.

Effective administrative and design controls that decrease hazardous chemical releases to the environment and help achieve compliance with permit requirements (that is, air emissions and NPDES permit requirements) contribute toward minimizing potential health impacts to the public. The effectiveness of these controls is verified through the use of monitoring information and inspection of mitigation measures. Health impacts to the public may occur during normal operations at the deep borehole site via inhalation of air containing hazardous chemicals released to the atmosphere by site operations. Risks to public health from other possible pathways, such as ingestion of contaminated drinking water or direct exposure, are low relative to the inhalation pathway.

Baseline air emission concentrations for hazardous chemicals and their applicable standards are included in the data presented in Sections 3.2.3 through 3.7.3. These concentrations are estimates of the highest existing offsite concentrations and represent the highest concentrations to which members of the public could be exposed. These concentrations are in compliance with applicable guidelines and regulations. Information about estimating health impacts from hazardous chemicals is presented in Section M.3.

Exposure pathways for workers at a generic deep borehole site during normal operation may include inhaling the workplace atmosphere and direct contact with hazardous materials associated with work assignments. The potential for health impacts varies from facility to facility and from worker to worker, and available information is not sufficient to allow a meaningful estimation and summation of these impacts. However, workers are protected from hazards specific to the workplace through appropriate training, protective equipment, monitoring, and management controls. Site workers are also protected by adherence to OSHA and EPA standards that limit workplace atmospheric and drinking water concentrations of potentially hazardous chemicals. Appropriate monitoring that reflects the frequency and amounts of chemicals utilized in the operational processes, ensures that these standards are not exceeded. Additionally, DOE requirements ensure that conditions in the workplace are as free as possible from recognized hazards that cause or are likely to cause illness or physical harm. Therefore, worker health conditions at a generic deep borehole site are expected to be substantially better than required by the standards.

Health Effects Studies. Specific locations for the deep borehole complex must be designated before any reviews of epidemiologic studies in the areas can be conducted.

Accident History. Since there is no deep borehole site in operation, there is no site accident history.

Emergency Preparedness. The generic deep borehole site would have an emergency management program that could be activated in the event of an accident. The program would be compatible with all other Federal, State, and local plans and be thoroughly coordinated with all interested groups. The program would be modified, as necessary, to accommodate deep borehole operations.

3.10.10 WASTE MANAGEMENT

This section describes the range of waste management activities and regulatory framework that could exist at a generic deep borehole site. The volume of waste generated by existing DOE sites varies greatly. Existing DOE sites also have a wide range of capability in the “cradle-to-grave” management of the various categories of wastes. Sites such as INEL, Hanford, and SRS have an extensive onsite treatment, storage, and disposal capability for most waste categories. Whereas, sites such as Pantex have a limited treatment and storage capability, and with the exception of a landfill for construction debris, have no onsite disposal capability. For generic deep borehole sites that would not be on or near a DOE facility, it is highly unlikely that there would be any ongoing waste management activities, except for a possible sanitary wastewater treatment facility or sanitary landfill. There are no regulations that clearly pertain to the disposal of surplus Pu material into a deep borehole. However, the regulations that would govern the waste management activities in support of the deep borehole are well-defined. A general discussion follows to describe the range of waste management activities if a deep borehole were located on or near a DOE facility.

Spent Nuclear Fuel. There would be no spent nuclear fuel associated with a deep borehole site.

High-Level Waste. There would be no HLW associated with a deep borehole site.

Transuranic Waste. Transuranic wastes are unique to DOE. Most TRU waste exists in a solid form and is comprised of protective clothing, paper trash, rags, glass, miscellaneous tools, and equipment that have become contaminated with TRU radionuclides. Liquid TRU wastes are generated from the chemical processing for recovery of Pu or other TRU elements. TRU wastes are managed in accordance with DOE Order 5820.2A. TRU wastes are to be processed and packaged to meet the WIPP WAC or alternate treatment level and placed in interim storage while awaiting the availability of a Federal repository. Mixed TRU waste must also meet the requirements of RCRA as outlined in 40 CFR 260. The generation of TRU waste at DOE sites ranges from 0 to 638 m³/yr (0 to 835 yd³/yr) and from 0 to 225 m³/yr (0 to 294 yd³/yr) for mixed TRU (DOE 1994d:122,124).

Low-Level Waste. Low-level waste is generated at more than 30 different DOE sites and is disposed of at Hanford, NTS, INEL, ORR, SRS, and LANL. LLW is usually rags, papers, filters, tools, equipment, and discarded protective clothing contaminated with radionuclides. In accordance with DOE Order 5820.2A, LLW must be characterized with sufficient accuracy to permit proper segregation, treatment, storage, and disposal. Waste acceptance criteria are established for each LLW treatment, storage, and disposal facility. For the 30 sites that generate LLW, the generation ranged from a few cubic meters (few cubic yards) to 14,090 m³/yr (18,430 yd³/yr) (DOE 1994d:145). The average land usage factor for the six DOE LLW disposal facilities ranges from 3,400 to 29,700 m³/ha (1,800 to 15,700 yd³/acres) (DOE 1994d:141,152).

Mixed Low-Level Waste. Mixed LLW at DOE sites includes a variety of contaminated materials, including air filters, cleaning materials, engine oils and grease, paint residues, photographic materials, soils, building materials, and plant equipment being decommissioned. In accordance with the *Federal Facility Compliance Act* of 1992, each DOE site that generates, stores, or treats mixed LLW has developed a Site Treatment Plan. The Site Treatment Plan lays out the development of technologies and capacities needed to treat mixed LLW to the standards required by RCRA. With approval of the plans, the regulatory agency issued an order requiring compliance with the approved plan. For those DOE sites that generated mixed LLW in 1993, the generation ranged from less than 1 m³ (1.3 yd³) to 1,900 m³ (2,485 yd³) (DOE 1994d:241).

Hazardous Waste. Hazardous wastes generated by DOE facilities include solvent rags, analytical laboratory chemicals, photographic shop wastes, spent solvents, waste oil, and paint wastes. Hazardous wastes are managed in accordance with RCRA as outlined in 40 CFR 260. Most DOE sites ship their hazardous wastes offsite to commercial RCRA-permitted facilities under contract, using DOT-registered transporters.

Nonhazardous Waste. The DOE generates the same kinds of liquid and solid nonhazardous wastes that any industrial facility would generate. Liquid nonhazardous wastes may undergo a wastewater treatment process before discharge to a publicly owned treatment works or surface waters. Wastewater treatment processes may include a neutralization of acidic or basic wastewater or flocculation/clarification. These liquid wastes are regulated by the CWA and are treated and discharged in accordance with NPDES permits and other state and local guidelines. Solid nonhazardous wastes are disposed of in onsite sanitary landfills that are owned and operated by DOE or shipped offsite to municipal landfills for disposal. The operation and management of solid nonhazardous wastes are regulated under the provisions of RCRA, Subtitle D.

3.11 MIXED OXIDE FUEL FABRICATION SITE (GENERIC)

For the generic MOX fuel fabrication facility, the environmental baseline is representative of an existing reactor fuel fabrication facility currently operating in the contiguous United States. Nuclear fuel fabrication on a commercial scale in the United States is currently limited to five major nuclear fuel fabricators. The five existing reactor fuel fabrication sites that were used as the basis for creating the generic environment are the following:

- ABB–Combustion Engineering, Hematite, MO
- Framatome Commercial Nuclear Fuel Plant, Lynchburg, VA
- General Electric Nuclear Production Facility, Wilmington, NC
- Siemens Nuclear Power Corporation, Richland, WA
- Westinghouse Columbia Fuel Facility, Columbia, SC

The commercial nuclear fuel facilities are primarily engaged in the manufacture of fuel assemblies for commercial nuclear reactors, both BWRs and PWRs. In general, the operations consist of receiving LEU hexafluoride (UF_6); converting the UF_6 to produce UO_2 powder; and processing the UO_2 through pressing and sintering, fuel rod loading and sealing, and fuel assembly fabrication. The fabrication varies in both process and magnitude from site to site.

Currently, there are no commercial U.S. fuel fabrication facilities licensed to process MOX fuel. Processing of MOX fuel in commercial facilities would require licensing by the NRC. The NRC licensing application process includes compliance with site-specific NEPA requirements.

| Department of Energy Activities. There are no major DOE activities at these commercial facilities.

Non-Department of Energy Activities. The range of primary missions of the commercial fuel fabrication facilities are as follows: one fabrication facility limits current operation to only loading fuel rods for PWRs; others provide a wide range of fuel fabrication for PWRs only or BWRs only; and one facility fabricates fuel for both BWRs and PWRs.

3.11.1 LAND RESOURCES

The approach to defining the generic MOX fuel fabrication site environmental setting for land resources is not site-specific. Consequently, a range of land use and visual resources conditions has been provided (see Table 3.11.1-1).

Table 3.11.1-1. Land Resources Attributes of the Generic Mixed Oxide Fuel Fabrication Site

Land Use Attributes	
Land Area	30 ha to 695 ha
Land Ownership	Public or Private
Percent of Site Area Developed	2 to 20 percent
Existing Land Use	
Onsite	Industrial; Undeveloped
Offsite	Forest land; Agriculture; Residential; Commercial; and/or Industrial
Land Use Compatibility	Likely
Plans, Policies, and Controls	
Jurisdiction	DOE; other Federal; State; local
Enforcement	Lax to stringent
Conformance	Likely
Visual Resource Attributes	
Landscape Character	
Site	Flat to gently rolling topography
Viewshed	Small to medium size urbanized area; surrounding agriculture; and/ or forest
Visual Resource	
Sensitivity level	Low to medium to high
Distance zones	Foreground, middleground, background, and seldom-seen
BLM VRM class	4 to 5
Degree of contrast	Weak to moderate

Source: BW NRC 1976a; BW NRC 1983b; CE 1989a; GE 1989a; GE 1989b; GE 1989c; GE NRC 1984a; NRC 1981b; NRC 1982a; SPC 1992a; WEC 1975a.

Land Use. The land area requirement for a site would range from 30 ha to 695 ha (74 acres to 1717 acres). Plant facilities would be sited upon only a portion of the total site area, with the developed portion likely to range from 2 to 20 percent. The range of land uses for the undeveloped portion of the site would be grassland, forest, or swamp land.

The location of a generic MOX fuel fabrication site would likely range in distance from less than 1 km to 5 km (0.6 mi to 3.1 mi) from the nearest community. Although a site could be located within a city corporate limit, it is more likely to be further from the closest city or metropolitan area, ranging between 6 and 56 km (3.7 and 34.8 mi) distant.

Land uses within the site vicinity would be described as rural, with forest land and agricultural uses predominating. The full range of land uses could include undeveloped uses such as forest and agriculture to developed uses such as residential, commercial, and industrial. The nearest residence would range from 200 to 800 m (656 to 2,625 ft) from the site boundary.

Depending on location, the site could be subject to a variety of land-use plans, policies, and controls at the Federal, State, and local level. The existence and stringency of these plans, policies, and controls could vary by jurisdiction. However, it is likely that site development would be in conformance with land-use plans, policies, and controls, and be compatible with adjacent land use.

Visual Resources. The visual environment of the site would likely be characterized by level to gently rolling topography. The site would be a developed area that contains facilities and activities, surrounded by undeveloped land. The viewshed would likely be rural with a low population density and with forested and agricultural uses predominating. Facilities would likely be visually unobtrusive due to site design, earthwork, and landscaping. The full range of sensitivity levels, and distance zones could occur (see Section 3.1.1 for discussion of visual resource inventory). Public viewpoints could include public access roadways, urbanized areas, and water-based recreational uses. It is likely that the degree of contrast would range from weak to moderate. The site would likely range from a Class 4 to Class 5 BLM VRM designation.

3.11.2 SITE INFRASTRUCTURE

Baseline Characteristics. The baseline characteristics for a generic MOX fuel fabrication site are provided in Table 3.11.2-1. Characteristics of a regional power pool to supply the generic MOX fuel fabrication site are given in Table 3.11.2-2.

Table 3.11.2-1. Generic Mixed Oxide Fuel Fabrication Site Baseline Characteristics

Characteristics	Site Availability
Transportation	
Roads (km)	3 to 9
Railroads (km)	0 to 4.3
Electrical	
Energy consumption (MWh/yr)	49,500 to 72,000
Peak load (MWe)	0.5 to 10
Fuel	
Natural gas (m ³ /yr)	0 to 102,800,000
Oil (l/yr)	0 to 9,130,000
Coal (t/yr)	0 to 208,700
Steam (kg/hr)	0 to 11,000

Source: CFFF 1995a:1; GE 1995a:1; SPC 1995a:1.

Table 3.11.2-2. Generic Mixed Oxide Fuel Fabrication Site Sub-Regional Power Pool Electrical Summary

Characteristics	Energy Production
Type Fuel^a	
Coal	14 to 59%
Nuclear	0 to 39%
Hydro/geothermal	2 to 46%
Oil/gas	<1 to 32%
Other ^b	0 to 30%
Total Annual Production	107,607,000 to 272,155,000 MWh
Total Annual Load	104,621,000 to 293,262,000 MWh
Energy Exported Annually	-45,400,000 to 6,359,000 MWh
Generating Capacity	24,870 to 61,932 MWe
Peak Demand	20,578 to 57,028 MWe
Capacity Margin^c	4,064 to 13,655 MWe

^a Percentage does not total 100 percent due to round-off error.

^b Includes power from both utility and nonutility sources.

^c Capacity margin is the amount of generating capacity available to provide for scheduled maintenance, emergency outages, system operating requirements, and unforeseen electrical demand.

Source: NERC 1993a.

3.11.3 AIR QUALITY AND NOISE

Meteorology and Climatology. The meteorological and climatological conditions for potential generic MOX fuel fabrication sites in the United States include a wide range of extremes in ambient temperature, windspeed and direction, and precipitation. Therefore, no further description of meteorology and climatology has been provided with respect to a generic site.

Ambient Air Quality. Ambient air quality conditions at representative existing fuel fabrication sites in the United States include a wide range of pollutants and conditions. The existing commercial fuel fabrication sites are all expected to comply with the ambient air quality standards. None of these sites is located in a nonattainment area.

Noise. Specific existing noise sources and characteristics of a generic MOX fuel fabrication site cannot be described. However, it is expected that the area near such a site would be essentially rural in character and would have typically low background sound levels. Typical DNL in the range 35 to 50 dBA (EPA 1974a:B-4) can be expected for such a rural location where noise sources may include wind, insect activity, aircraft, and agricultural activity. Existing industrial noise sources and traffic noise at the site would result in higher background noise levels near the site and along site access routes.

3.11.4 WATER RESOURCES

Surface Water. Major surface water features in the generic MOX fuel fabrication site could range from none to a large navigable river. The average flow rate of these water bodies could range from 0 to 3,360 m³/s (0 to 118,658 ft³/s). Other surface water features could include small streams bordering the site with average flows ranging from comparable to the main surface water body's to negligible in comparison.

Stormwater control retention/drainage ponds could be present at the site. These ponds would probably discharge to the nearest surface water body, or to natural drainage channels. Portions of the site could be located within the 100-year floodplain.

Surface Water Quality. In the vicinity of the generic MOX fuel fabrication site, the surface water bodies could range from being classified as fresh water suitable for drinking water, contact recreation, and propagation of fish and aquatic life, to not suitable for drinking, bathing, or commercial shellfishing. The range of concentrations of typical surface water quality parameters that could be encountered at a generic site is the same as was presented in Table 3.10.4-1.

The generic commercial MOX fuel fabrication site would have an NPDES permit(s) that would dictate the acceptable levels of specific parameters in the liquid effluents that would be discharged to a nearby surface water body.

Surface Water Rights and Permits. Surface water rights concerning the water body near the generic MOX fuel fabrication site would involve non-impairment of designated uses.

Groundwater. The near-surface aquifer beneath the generic MOX fuel fabrication site would occur under unconfined conditions and could range in average thickness from 5 to more than 20 m (16.4 to more than 66 ft). Depth to groundwater could range from near the ground surface to more than 200 m (656 ft). The aquifer material could range from sand and gravel to saprolite, or highly weathered bedrock. In general, the generic MOX fuel fabrication site would obtain groundwater from a confined aquifer underlying the near-surface aquifer. The confined aquifer would have an abundant supply of good quality groundwater.

Recharge to the near-surface aquifer would be primarily from rainfall and would occur in areas located up to 10 km (6.25 mi) from the site. Groundwater flow would typically be from these recharge areas towards the major surface water feature.

In areas surrounding the generic MOX fuel fabrication site, groundwater would be used for domestic, agricultural, and industrial purposes. The classification of the aquifer would be a Class II aquifer (that is, currently being used or a potential source of drinking water).

Groundwater Quality. Groundwater quality of the near-surface aquifer in the site area would range from good to fair. The ranges of hydraulic characteristics of the aquifer are presented in Table 3.10.4-2.

Groundwater Availability, Use, and Rights. Groundwater rights concerning the aquifer(s) near the generic MOX fuel fabrication site could range from having potential for local restrictions on pumping to a reasonable use doctrine concerning neighboring landowners water availability.

3.11.5 GEOLOGY AND SOILS

Geology. The physiography of a generic MOX fuel fabrication site could range from a flat, nearly featureless plain to a highly dissected plain of arid to humid environments. Similarly, the area geology could range from alluvium to thick sequences of unconsolidated marine sediments, glaciofluvial material, and crystalline and sedimentary bedrock. These materials could range in age from Cenozoic to Precambrian (recent to over 600 million years).

A generic MOX fuel fabrication site could be located in Seismic Zones 1 to 3, which suggests there could be minor to major levels of damage in the event of an earthquake (Figure 3.2.5–1). [Text deleted.] The geologic terrain for Seismic Zones 1 through 3 of those areas considered for the generic MOX fuel fabrication site could have a history of seismic activity that ranges from low to severe. The nearest capable fault could be within 250 km (155 mi) of the generic MOX fuel fabrication site. The nearest local earthquake with a MMI of V could be within 170 km (106 mi) from a generic MOX fuel fabrication site (Table 3.2.5–1). The nearest epicenter from a damaging earthquake (MMI of VII or greater) could be approximately 170 km (106 mi) from a generic MOX fuel fabrication site.

Although the generic MOX fuel fabrication site is not located within a region of active volcanism, it could be located within approximately 164 km (102 mi) of a volcano.

Soils. The generic MOX fuel fabrication site could be located where the predominant soil types are loamy sands to loamy clays. These soils could range from poorly to excessively drained. The erosion potential could range from minor to severe in those areas with slopes greater than 25 percent and that have been eroded in the past. The soil's shrink-swell potential could range from minimal to severe, which is acceptable for standard construction techniques, depending upon the engineering controls employed. Wind erosion potential could range from minimal to severe.

3.11.6 BIOLOGICAL RESOURCES

The affected environment for the generic MOX fuel fabrication site is based on a review of biological conditions characteristic of several commercial reactor fuel fabrication facilities currently operating in the United States. Biological resources at a given site could vary from those typically associated with the principal vegetation type of the area due to a variety of factors, including previous disturbance by man. The principal vegetation types found within these representative environments include deciduous forest, southeastern evergreen forest, and grassland. With the exception of southeast evergreen forest, biological resources found within these vegetation types are discussed in Section 3.10.6.

Southeast Evergreen Forest. Southeast evergreen forest occurs along the Atlantic coastal plain from the mid-Atlantic States to Florida and along the northern Gulf Coast. The climate varies from distinct seasonal changes in the mid-Atlantic region to only minor seasonal variation in Florida and along the Gulf Coast. Pines, such as pitch, longleaf, and slash, are the dominant tree species within this vegetation type. Pine forests owe their origin and maintenance to their resistance to fire, which inhibits the growth of deciduous species. In the absence of fire, this forest type would be replaced by oak-hickory dominated forest. Animals associated with the southeast evergreen forest include the whitetail deer, opossum, gray fox, northern bobwhite, wild turkey, eastern bluebird, morning dove, eastern diamondback rattlesnake, American alligator and pine woods treefrog. Streams and rivers within this vegetation type are generally slow moving and are often bordered by forested swamps and bottomland hardwood forests.

3.11.7 CULTURAL AND PALEONTOLOGICAL RESOURCES

Prehistoric Resources. Prehistoric resources may be affected by the construction and operation of the generic MOX fuel fabrication facility. These resources may include objects, sites, or features such as remains of storage pits, or hearths. Archaeological sites may include hunting and butchering sites and campsites. Sites may yield artifacts such as stone tools and associated manufacturing debris, and ceramic potsherds.

Historic Resources. Historic resources that could be affected by construction and operation may include subsurface remains of human occupation such as structural foundations of buildings, important paths or roads, and cemeteries. Some standing buildings such as commercial structures and residences also may be considered historic resources.

Native American Resources. Native American resources could be affected by construction and operation of this facility. Resources may include sites, areas, and materials important to Native Americans for religious or heritage reasons. Sacred sites may include cemeteries, plant communities, mountains, paths, or geographical spaces that are socially identified and circumscribed. Some Native American groups could be affected and would need to be consulted if a specific site is chosen.

Paleontological Resources. Paleontological resources could be affected. These resources may include fossil remains of extinct plants or animals, some rare. They can include poorly known fossil forms, well-preserved terrestrial vertebrates, unusual depositional contexts, assemblages that contain a variety of fossil forms, or deposits recovered from poorly studied regions or in unusual concentrations.

3.11.8 SOCIOECONOMICS

The generic MOX fuel fabrication site could potentially affect the socioeconomic environment of a given REA or ROI. The characteristics of the REA, ROI, and community are dependent upon geographic location. For employment and income, the economic area would be based upon industry interaction and linkages in the region. The anticipated residential distribution of project-related employees and their families would determine the ROI. This ROI would contain all principal jurisdictions and school districts likely to be affected by the proposed activity.

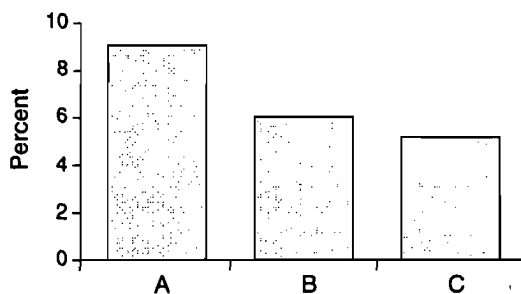
Because specific sites have not been proposed for the generic MOX fuel fabrication facility, representative sites have been used to describe the affected environment. Five existing facilities encompassing three location types were used as representative sites to develop a range of conditions for discussion in this section. Two of the sites, A and B, are located in medium communities located in urban areas. The third site, C, is a small community tied to a large metropolitan area. Medium-size communities and the vulnerability or susceptibility of a local community to changes in the economic base are characterized in Section 3.10.8.

Small communities tied to large metropolitan areas would be characterized by a rural ROI within a large metropolitan REA. The ROI would have attributes similar to rural areas and small rural communities. The population would normally be less than 50,000. There would be small business centers with a small work force and little local diversification of industries and employment. However, the large metropolitan area nearby should provide employment for a significant portion of the rural community's population. The resulting increase in tax base and diversification of employment would strengthen the community's economic base and allow for a higher level of community services than found in a more isolated rural area. Infrastructure and transportation networks would normally be more developed in the rural community linked to a large metropolitan area than in a more isolated community. This would be due, in part, to the requirement for good commuting routes to the large metropolitan area. The large metropolitan area to which the rural community is linked would have a population of at least 1 million. These communities would usually be independent centers of large-scale financial, wholesaling, and service activity. These areas would typically have high population densities and numerous employment centers. Economically supportive relationships between industries would be developed, and a large pool of labor would exist. Large and diverse metropolitan areas would provide a wide range of goods and services to local residents.

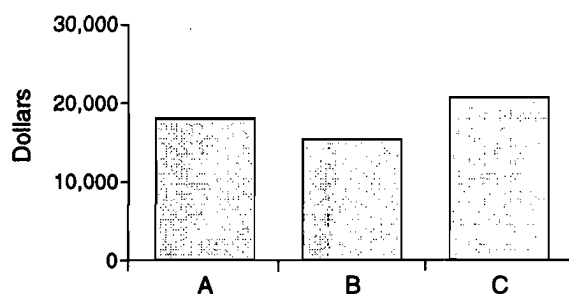
Socioeconomic characteristics described for the generic MOX fuel fabrication site include employment and local economy, population and housing, and local transportation. The communities of three typical sites were assessed. Site A, which had a 1992 population of 34,201 and a total urban population of more than 100,000, represents the smaller medium-size community being assessed; Site B, with a 1992 population of 98,832, represents the larger medium-size community being assessed. Site C was a small community whose population was incorporated into the population of the surrounding county. Site C was located approximately 16 km (10 mi) from a small community of 4,096 persons (1992 population) and about 64 km (40 mi) from a large metropolitan area of approximately 1.5 million persons. Statistics for employment and local economy were based on the REA for each site. Statistics for the remaining socioeconomic characteristics were based on the sites' ROIs.

Regional Economy Characteristics. Selected employment and regional economy statistics for each typical site's REA are discussed in this section and displayed in Figure 3.11.8–1. Between 1980 and 1990, the civilian labor force in the REA encompassing Site A increased 9.9 percent to the 1990 level of 254,800, and in Site B increased 19 percent to the 1990 level of 399,100. Site C had a 12.6 percent increase (the 1990 civilian labor force was 1,476,800). The 1994 unemployment for the REA encompassing Site A was 9.1 percent while Site B had unemployment of 6 percent. The unemployment for Site C was 5.3 percent. The 1993 per capita income was \$18,501 and \$16,832 for Sites A and B, respectively. Site C had a 1993 per capita income of \$20,554.

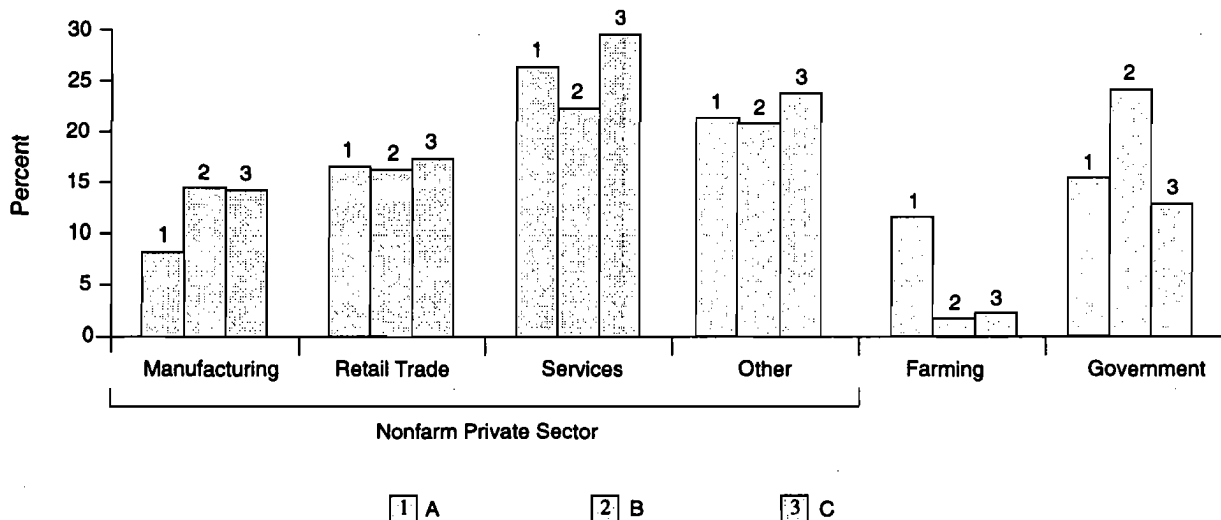
Unemployment Rate for the Generic MOX Fuel Fabrication Representative Sites' REA 1994^a



Per Capita Income for the Generic MOX Fuel Fabrication Representative Sites' REA 1993^b



Total Sector Employment for the Generic MOX Fuel Fabrication Representative Sites' REA 1993^b



^a DOL 1995a.

^b DOC 1995a.

Figure 3.11.8-1. Employment and Local Economy for the Generic Mixed Oxide Fuel Fabrication Representative Sites' Regional Economic Area.

Figure 3.11.8-1 displays the division of employment involving farming, nonfarm private sector, and government employment around each representative site. The portion of total REA employment involving farming was 12 percent at Site A and 2 percent at Site B. Government activities accounted for 15 and 24 percent of the total regional employment at sites for A and B, respectively. Employment involving manufacturing was 8 percent of the total employment in the region surrounding Site A and 14 percent in the region around Site B. Retail trade activities represented approximately 16 percent of the nonfarm private sector employment for Site A and Site B. Service activities represented a 26-percent share of this employment for Site A, and a 22 percent share at Site B.

For Site C, the portion of total employment involving farming and government activities was 2 percent and 13 percent, respectively. The nonfarm private sector activities of manufacturing and retail trade represented 14 percent and 17 percent, respectively, of the total regional employment. Employment in the service sector was 29 percent.

Population and Housing. Population and housing trends in the ROIs of the three typical communities are presented in Figure 3.11.8-2. The ROI population increases for Sites A and B between 1980 and 1994 were 19.8 percent (average annual increase of 1.3 percent) and 18.1 percent (average annual increase of 1.3 percent), respectively. The number of housing units, between 1980 and 1990, in the ROI increased 5.4 percent for Site A and 21.6 percent for Site B. The 1990 ROI homeowner vacancy rates were 1.3 percent for Site A and 1.9 percent for Site B, while the renter vacancy rates were 5.6 percent and 8.9 percent for Sites A and B, respectively.

The ROI surrounding Site C experienced a 5.2-percent (average annual increase of 0.4 percent) increase in population, between 1980 and 1994, and an 11.9-percent increase in the number of housing units between 1980 and 1990. The 1990 homeowner and renter vacancy rates were 1.8 and 9.1 percent, respectively.

Community Services and Local Transportation. These characteristics are dependent upon a geographic location. The ROI would determine all principal jurisdictions and school districts likely to be affected by the proposed activity. Local transportation would be the existing principal road, air, and rail networks required to support the project activities.

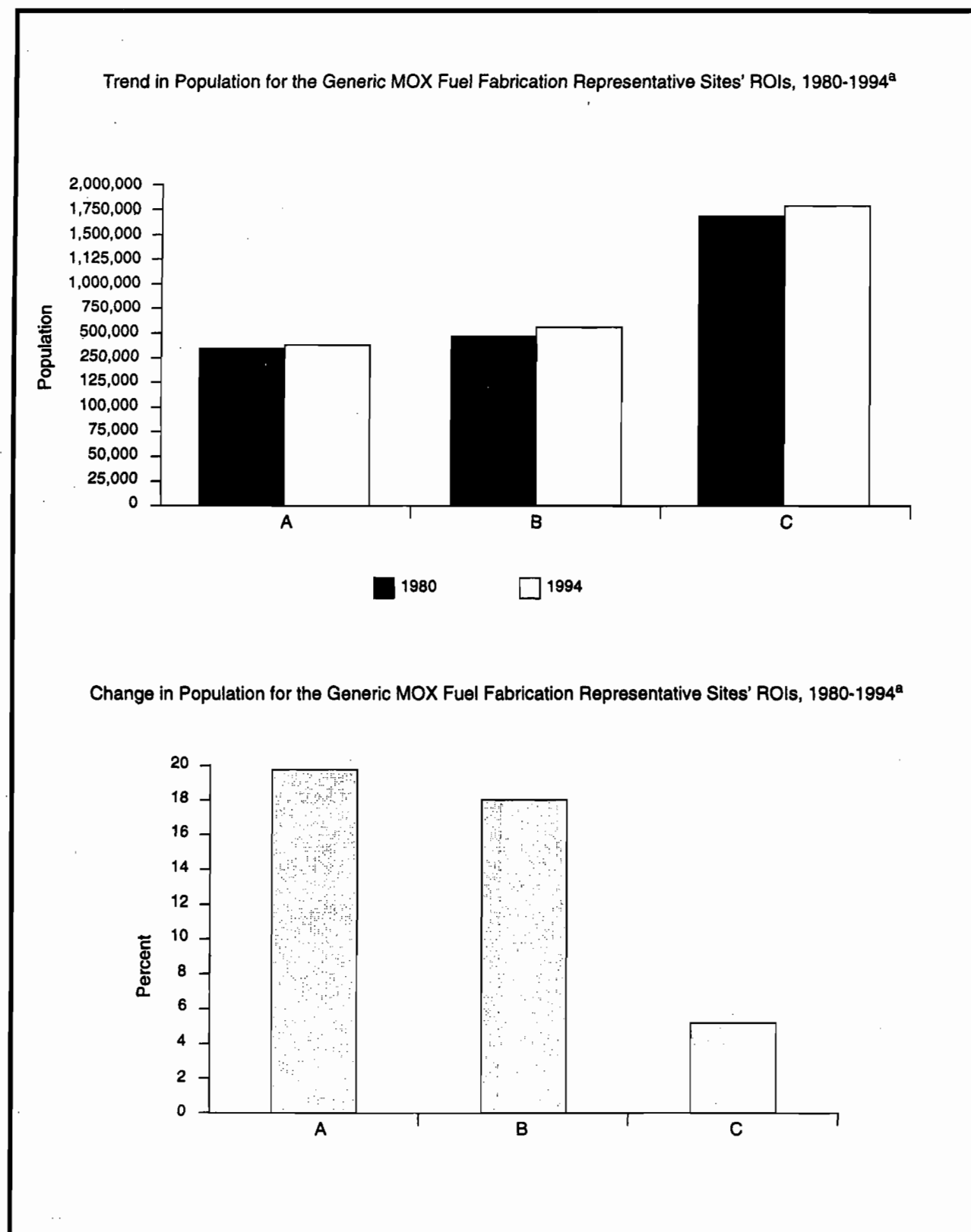


Figure 3.11.8-2. Population and Housing for the Generic Mixed Oxide Fuel Fabrication Representative Sites' Region of Influence.

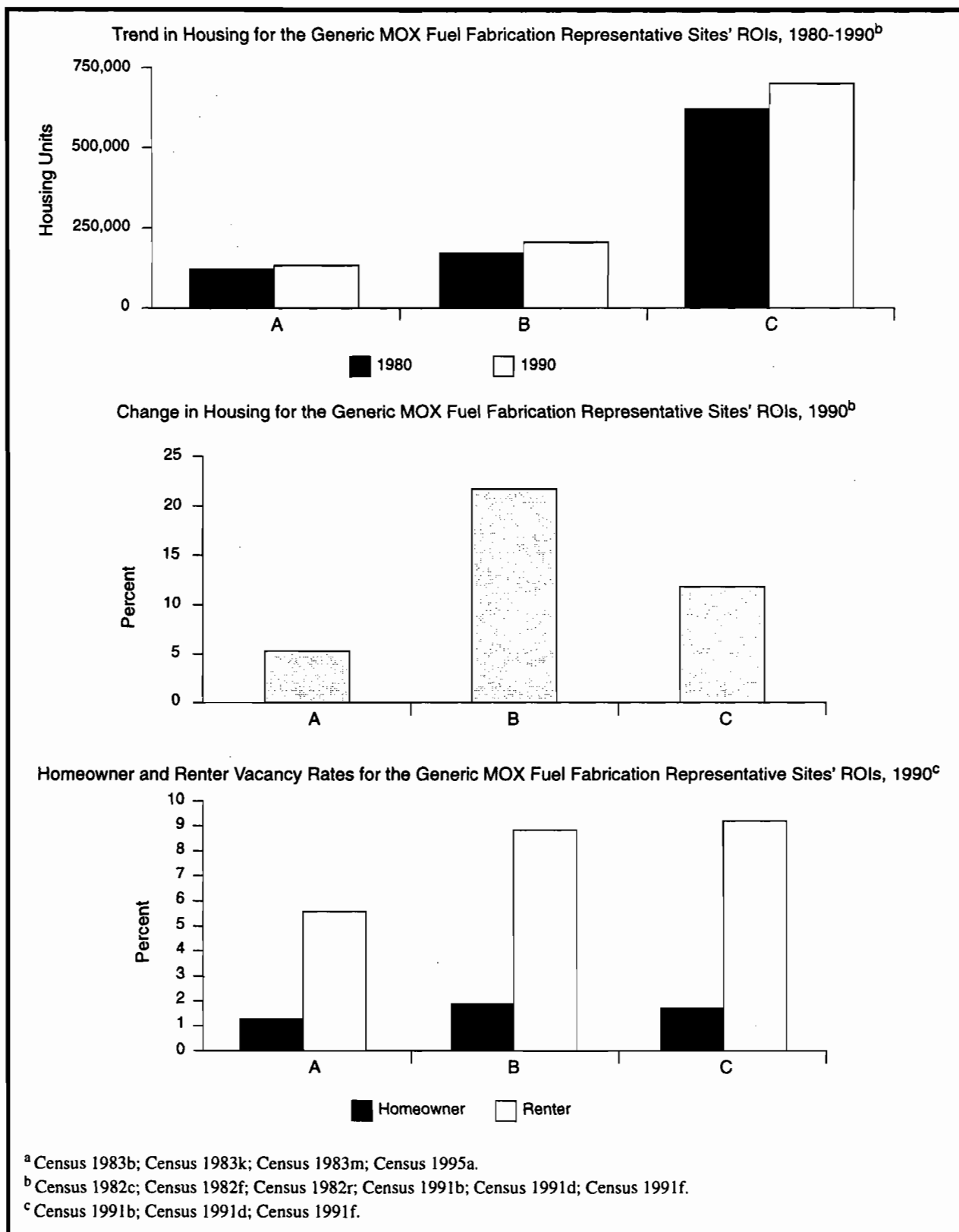


Figure 3.11.8-2. Population and Housing for the Generic Mixed Oxide Fuel Fabrication Representative Sites' Region of Influence—Continued.

3.11.9 PUBLIC AND OCCUPATIONAL HEALTH AND SAFETY

Radiation Environment. Major sources and levels of representative background radiation exposure to individuals in the vicinity of a generic MOX fuel fabrication site are shown in Table 3.11.9-1. Annual background radiation doses to individuals are expected to remain constant over time. The total dose to the population changes as the population size changes. Background radiation doses are unrelated to normal facility operation.

Table 3.11.9-1. Sources of Radiation Exposure to Individuals in the Vicinity, Unrelated to Operation at the Generic Mixed Oxide Fuel Fabrication Site

Source	Effective Dose Equivalent (mrem/yr)
Natural Background Radiation	
Cosmic and cosmogenic radiation ^{a,b}	27 to 28
External terrestrial radiation ^a	15 to 44
Internal terrestrial radiation ^b	39
Radon in homes (inhaled) ^b	200
Other Background Radiation^b	
Diagnostic x rays and nuclear medicine	53
Weapons test fallout	<1
Air travel	1
Consumer and industrial products	10
Total	346 to 376

^a Based on information on cosmic and terrestrial radiation given in EPA 1981b.

^b NCRP 1987a.

Note: Value for radon is an average for the United States.

Releases of radionuclides to the environment from normal facility operations provide another source of radiation exposure to individuals in the vicinity of a given site. For a range of existing conditions, types and quantities of radionuclides released from operations at a generic MOX fuel fabrication site is based on 1994 radiological effluent release reports for existing representative commercial fuel fabrication sites involved in the processing and fabrication of uranium ore into reactor fuel. The doses to the public resulting from these releases are presented in Table 3.11.9-2. These doses fall within radiological limits (40 CFR 61, 40 CFR 141, and 40 CFR 190) and are small in comparison to background radiation. The releases listed in the 1994 reports were used in the development of the reference environment's (No Action) radiological releases and resulting impacts at the generic MOX fuel fabrication sites in the year 2005 (Section 4.3.5.1.9).

Based on a risk estimator of 500 cancer deaths per 1 million person-rem to the public (Section M.2.1.2), the fatal cancer risk to the maximally exposed member of the public due to radiological releases from operations at the representative fuel fabrication sites in 1994 is estimated to range from 2.5×10^{-7} to 5.5×10^{-7} . That is, the estimated probability of this person dying of cancer at some point in the future from radiation exposure associated with 1 year of operations at the representative fuel fabrication site ranges from less than 3 in 10 million to less than 6 in 10 million. (Note that it takes several to many years from the time of exposure to radiation for a cancer to manifest itself.)

Based on the same risk estimator, a range of 1.8×10^{-4} to 5.8×10^{-3} excess fatal cancers is projected in populations living within 80 km (50 mi) of the representative fuel fabrication sites from normal operations in 1994. To place these numbers into perspective, they can be compared with the numbers of fatal cancers expected in these

Table 3.11.9-2. Radiation Doses to the Public From Normal Operation at the Generic Mixed Oxide Fuel Fabrication Site in 1994 (Committed Effective Dose Equivalent)

Members of the General Public	Atmospheric Releases		Liquid Releases		Total	
	Standard ^a	Actual	Standard ^a	Actual	Standard ^a	Actual
Maximally exposed individual (mrem)	10	0.058 to 0.50	4	0.002 to 1.0	25	0.50 to 1.1
Population within 80 km ^b (person-rem)	None	0.30 to 11.1	None	0.050 to 0.48	None	0.35 to 11.6
Average individual within 80 km ^c (mrem)	None	5.7×10^{-4} to 0.013	None	9.5×10^{-5} to 5.7×10^{-4}	None	6.7×10^{-4} to 0.014

^a The standards for individuals are given in 40 CFR 61, 40 CFR 141, and 40 CFR 190. As discussed in these regulations, the 10 mrem per year limit from airborne emissions is required by the CAA, the 4 mrem per year is required by the SDWA, and the total dose of 25 mrem per year is the limit from all pathways combined.

^b In 1994, this population ranged from 525,000 to 848,000.

^c Obtained by dividing the population dose by the number of people living within 80 km of the site.

Source: BW 1995b:1; WEC 1975a; WEC 1995a:1.

populations from all causes. The 1990 mortality rate associated with cancer for the entire U.S. population was approximately 0.2 percent per year (Almanac 1993a:839). Based on this mortality rate, the number of fatal cancers expected to occur during 1994 from all causes ranged from 1,050 to 1,700 in the population living within 80 km (50 mi) of a fuel fabrication site. These numbers of expected fatal cancers are much higher than the estimated range of 1.8×10^{-4} to 5.8×10^{-3} fatal cancers that could result from operations at commercial fuel fabrication sites in 1994.

Site workers receive the same dose as the general public from background radiation but also receive an additional dose from working in the site facilities. Table 3.11.9-3 presents the range of the average worker, maximally exposed worker, and total cumulative worker dose from operations at the representative fuel fabrication sites in 1993. These doses fall within radiological regulatory limits (10 CFR 20). Based on a risk estimator of 400 fatal cancers per 1 million person-rem among workers (Section M.2.1.2), the number of excess fatal cancers to workers from site operations in 1993 is estimated to range from 0.0028 to 0.039.

Table 3.11.9-3. Radiation Doses to Workers From Normal Operation at the Generic Mixed Oxide Fuel Fabrication Site in 1993 (Committed Effective Dose Equivalent)

Occupational Personnel	Onsite Releases and Direct Radiation	
	Standard ^a	Actual
Average worker (mrem)	ALARA	33 to 159
Maximally exposed worker (mrem)	5,000	<3,000
Total workers (person-rem)	ALARA	7.0 to 98

^a NRC's goal is to maintain radiological exposure as low as reasonably achievable.

Source: 10 CFR 20; NRC 1995b.

A more detailed presentation of the radiation environment, including background exposures and radiological releases and doses, is presented in the 1994 effluent release reports and environmental reports. The concentrations of radioactivity in various environmental media (including air, water, and soil) in the regions of the sites (onsite and offsite) are also presented in those reports.

Chemical Environment. The background chemical environment important to human health consists of the atmosphere, which may contain hazardous chemicals that can be inhaled; drinking water, which may contain hazardous chemicals that can be ingested; and other environmental media with which people may come in contact (for example, surface waters during swimming and soil through direct contact or via the food pathway). The baseline data for assessing potential health impacts from the chemical environment are those presented in Section 3.11.3.

Effective administrative and design controls that decrease hazardous chemical releases to the environment and help achieve compliance with permit requirements (that is, air emissions and NPDES permit requirements) contribute toward minimizing potential health impacts to the public. The effectiveness of these controls is verified through the use of monitoring information and inspection of mitigation measures. Health impacts to the public may occur during normal operations at the fuel fabrication site via inhalation of air containing hazardous chemicals released to the atmosphere by site operations. Risks to public health from other possible pathways, such as ingestion of contaminated drinking water or direct exposure, are low relative to the inhalation pathway.

A discussion of ambient air quality is given in Section 3.11.3. As stated in that section, air quality is expected to be in compliance with applicable standards. Information about estimating health impacts from hazardous chemicals is presented in Section M.3.

Exposure pathways for workers at the fuel fabrication site during normal operations may include inhaling the workplace atmosphere and direct contact with hazardous materials associated with work assignments. The potential for health impacts varies from facility to facility and from worker to worker, and available information is not sufficient to allow a meaningful estimation and summation of these impacts. However, workers are protected from hazards specific to the workplace through appropriate training, protective equipment, monitoring, and management controls. Site workers are also protected by adherence to OSHA and EPA standards that limit workplace atmospheric and drinking water concentrations of potentially hazardous chemicals. Appropriate monitoring that reflects the frequency and amounts of chemicals utilized in the operational processes ensures that these standards are not exceeded. Therefore, worker health conditions are expected to be substantially better than required by the standards.

Health Effects Studies. Specific locations for the MOX fuel fabrication facilities must be designated before any reviews of epidemiologic studies in the areas can be conducted.

Accident History. Domestic MOX fuel fabrication facilities do not presently exist. Consequently, there is no accident history available.

Emergency Preparedness. The generic MOX fuel fabrication site would develop an emergency management program which would be activated in the event of an accident. The program would be compatible with all other Federal, State, and local plans and is thoroughly coordinated with all interested groups. [Text deleted.]

3.11.10 WASTE MANAGEMENT

This section describes the range of waste management activities and the regulatory framework that exist at a generic fuel fabrication site in the United States. These commercial facilities would need to be licensed by NRC to handle Pu. To meet the requirements of their NRC license, the generic fuel fabrication site complies with Federal and State regulations of water, air, and land disposal in addition to facility permits. Agencies responsible for enforcement and inspection at a commercial nuclear fuel fabrication facility include the NRC, EPA, and the State's appropriate regulatory agencies. State agencies govern effluent discharge; nonhazardous waste disposal; hazardous waste treatment, storage, and disposal; underground storage tanks; incineration; and transport of hazardous waste.

A generic fuel fabrication site receives low-enriched UF_6 and/or UO_2 (made from natural or depleted uranium) as powder. The UO_2 powder is pressed into pellets, which are sintered, ground to final size, and loaded into fuel rods that are then fabricated into reactor fuel bundles. Wastes produced at this site are categorized as low-level, mixed low-level, hazardous, and nonhazardous. Activities at a generic fuel fabrication site that generate waste include uranium blending; pelleting; sintering; grinding; coating; fuel rod loading and inspection; scrap recovery; incineration of low-level radioactive, mixed low-level, hazardous, and nonhazardous wastes; recovery of zirconium and copper; waste compaction; and waste processing and research related to the recovery of uranium. Incoming materials to the site includes zircalloy tubing, UO_2 , nitric acid, water, and natural gas. Exit streams from the site typically include product fuel elements and assemblies; recovered metals; and gaseous, liquid, and solid waste.

The low-level, mixed, hazardous, and nonhazardous wastes are treated to reduce either volume or toxicity for subsequent recycle, storage, or disposal. The quantity of waste and the characteristics of the waste would depend on the fabrication process and the method of treatment used. The following discussions describe the waste management practices that are used at a generic fuel fabrication site.

Spent Nuclear Fuel. The site does not generate or manage spent nuclear fuel.

High-Level Waste. The site does not generate or manage HLW.

Transuranic Waste. The site does not generate or manage TRU waste.

Low-Level Waste. The site produces both liquid and solid LLW; however, liquid LLW is processed for uranium scrap recovery and dried to solids before disposal. Liquid LLW is generated in uranium recovery and gaseous emissions cleanup operations. Many of the manufacturing operations are dry chemical reactions, thus minimizing the generation of liquid LLW. Manufacturing process liquid wastes include acid dissolution, washwater from the laundry and personnel stations, analytical laboratory liquids, and scrubber water from the acid treatment and incineration operations.

The liquid LLW generated can be treated using evaporation, filtration, centrifugation, or ion exchange in a liquid radioactive waste treatment facility. After the complete treatment process, final dried solids are produced that can either be incinerated for further uranium recovery or packaged for offsite disposal at a licensed LLW disposal facility. Liquid effluents from the process can be transferred to a retention tank system and ultimately released to a sanitary sewer or into the local river in accordance with the generic fuel fabrication site's NPDES permit.

Solid waste that is categorized as LLW results from uranium recovery, liquid waste management, and incineration; this waste includes paper, small pieces of equipment, sludge, and miscellaneous trash. Another form of solid LLW results from gaseous waste streams with measurable amounts of radioactive materials that are passed through HEPA filters. These filters are disposed of as LLW. The solid waste produced can be incinerated, and the remaining packaged for offsite disposal. A supercompactor can exist onsite that compacts

208-l (55-gal) drums containing LLW. At a generic fuel fabrication site, the total solid LLW volume is expected to be approximately 41 m³/yr (54 yd³/yr).

Mixed Low-Level Waste. The generic fuel fabrication site could process uranium-containing material using distillation. The sludge bottoms from this process are categorized as mixed LLW. The mixed waste is packaged and stored onsite at a dedicated facility until disposal becomes feasible. The volume of mixed waste generated annually at a generic fuel fabrication site is estimated to be 2 m³/yr (2.6 yd³/yr).

Hazardous Waste. Liquid hazardous wastes generated at a generic fuel fabrication site result from acid pickling, metals cleaning, and emissions control operations. Solid hazardous wastes are generated through the liquid hazardous waste treatment operations. The primary treatment methods that are used for liquid hazardous wastes are advanced wastewater treatment, lagoons, precipitation, and retention tanks pending discharge to the local river or sewer system in accordance with the site's NPDES permit. Sludges from these processes are recycled or packaged and shipped offsite for treatment and disposal.

Nonhazardous Waste. Liquid sanitary waste is processed at a generic fuel fabrication site. The primary treatment methods for this waste include sanitary treatment, aeration, and chlorination. As with the other treatment processes for liquid waste, the effluent is ultimately discharged into the local river or sewer system in accordance with the site's NPDES permit. Solid nonhazardous waste at the generic fuel fabrication site includes miscellaneous trash and paper, classified paper, and scrap zirconium and copper. Miscellaneous trash is sorted and packaged for onsite or offsite disposal.

3.12 EXISTING LIGHT WATER REACTOR SITE (GENERIC)

Currently in operation are 110 commercial nuclear power reactors located at 72 sites in 32 of the contiguous United States. Of these, 58 sites are located east of the Mississippi River. Most of this nuclear capacity is located in the Northeast (New England States, New York, and Pennsylvania), the Midwest (Illinois, Michigan, and Wisconsin), and the Southeast (the Carolinas, Georgia, Florida, and Alabama). No commercial nuclear power plants are located in Alaska or Hawaii. Approximately half of these 72 sites contain 2 or 3 nuclear units per site. Typically, nuclear power plant sites are located on, and are situated near, flat-to-rolling countryside in wooded or agricultural areas. More than 50 percent of the sites have 80 km (50 mi) population densities of less than 77 persons per km² (200 persons per mi²), and over 80 percent have 80 km (50 mi) densities of less than 193 persons per km² (500 persons per mi²). Site areas range from 34 to 12,000 ha (84 to 30,000 acres). Almost 60 percent of the plant sites encompass 200 to 800 ha (500 to 2,000 acres). Larger land-use areas associated with plant cooling systems include reservoirs, artificial lakes, and buffer areas. Because it is beyond the scope of this PEIS to analyze all of them, the environmental baseline for the existing LWR was developed as a generic environmental site description that is representative of an existing reactor site located somewhere in the contiguous United States.

A sample of reactors from across the United States was compiled in order to generate generic operating characteristics for a commercial LWR, since no specific site or reactor has been selected. The sample was studied in detail to determine valid, applicable characteristics that could be used to describe a generic reactor using MOX fuel. The sample sites would not be an exhaustive list of potential sites but are used to define the generic affected operational and environmental characteristics. The sample includes eight operating high power (greater than 1,200 MWe) PWRs and four BWRs built after 1975. Characteristics of these 12 were felt to be representative of both reactor types, since none of the 12 experienced any unusual operating conditions over the operating period reviewed. Where possible, data was averaged for the 5-year period to smooth out unusually low or high values due to shutdowns for reasons other than normal refueling or maintenance activities.

Data for each reactor characteristic were taken from calendar years 1988 to 1992 (ORNL 1995b:A-5). Entries for all 12 plants were used to determine an average for each operational characteristic (for example, waste generated).

For determining the environmental setting (for example, land area) of the generic reactor site, a second set of 10 reactors at 5 existing commercial reactor sites located across the United States were selected. These sites were as follows:

- Byron #1 and #2, IL
- Catawba #1 and #2, SC
- LaSalle #1 and #2, IL
- Palo Verde #1, #2, and #3, AZ
- WNP #2, WA

3.12.1 LAND RESOURCES

The approach to defining the environmental setting for land resources is not site specific. Consequently, a range of land use and visual resources conditions for a generic existing LWR site has been provided (see Table 3.12.1–1).

Table 3.12.1–1. Land Resources Attributes of the Generic Existing Light Water Reactor Site

Land Use Attributes	
Land Area	419 ha to 1,640 ha ^a
Land Ownership	Public or private
Percent of Site Area Developed	
With cooling towers	3 to 9 percent
With cooling lakes	67 to 76 percent
Existing Land Use	
Onsite	Industrial; Undeveloped
Offsite	Forest land; Agriculture; Residential; Commercial; and/or Industrial
Land Use Compatibility	Likely
Plans, Policies, and Controls	
Jurisdiction	DOE; Other Federal; State; local
Enforcement	Lax to stringent
Conformance	Likely
Visual Resource Attributes	
Landscape Character	
Site	Flat to gently rolling topography; adjacent to large water body
Viewshed	Small to medium size urbanized area; surrounding agriculture; and/ or forest
Visual Resource	
Sensitivity level	Low to medium to high
Distance zones	Foreground, middleground, background, and seldom-seen
BLM VRM class	5 (developed area)
Degree of contrast	NA (existing)

^a Land area already dedicated.

Note: NA=not applicable.

Source: NRC 1982b.

Land Use. The land area requirement for a generic existing LWR site could range from 419 to 1,640 ha (1,035 to 4,050 acres). However, this land area has already been dedicated; additional land area is not required. Plant facilities would probably be sited on 3 to 9 percent of the total site area. For sites that utilize cooling ponds instead of cooling towers, facilities could occupy a larger percentage of total site area (67 to 76 percent). The site could contain multiple (ranging from one to three) nuclear units. The area of the site not utilized for facilities and activities would be left undeveloped, and the range of land uses would likely be forested land, open space, or reserve/refuge.

The location of a generic existing LWR site would range between 3 to 55 km (2 to 34 mi) from the nearest city. The site would likely be further from the closest metropolitan area, up to 80 km (50 mi) distant. The site would be located adjacent to a large water body, such as a lake or river. Land use in the site vicinity could range from

agricultural or forest uses to developed land uses such as residential, commercial, or industrial. The nearest residence to a generic existing LWR site would range from 1 to 6.5 km (0.6 to 4 mi) distant.

As this is an existing condition, site development would be in conformance with land-use plans, policies, and controls. Likewise, land-use incompatibility would not be an issue.

Visual Resources. The visual environment of a generic existing LWR site would likely be characterized by flat to gently rolling topography adjacent to a large water body. The site would be a developed area that contains facilities and activities, encompassed by an undeveloped buffer area. The viewshed would likely include a small- to medium-sized urbanized area with surrounding forest and agricultural use. Depending on topography, atmospheric conditions, vegetation, and distance, the facilities of a generic existing LWR site could be visible from adjacent viewpoints. Stack plumes from cooling towers could be visible under most meteorological conditions. Median visible plume lengths would usually range from less than 500 m (1,640 ft) in summer to 1000 m (3,280 ft) in winter (NRC 1981a:5-6,5-7). The facilities would be brightly lit at night. The range of public viewpoints could include public access roadways, urbanized areas, and recreation/scenic areas with high user volumes. The full range of sensitivity levels, and distance zones would occur (see Section 3.1.1 for discussion of visual resource inventory). Since the site would be adjacent to a large water body, it would be likely that distance zones would range from foreground to middleground. The developed areas of a generic existing LWR site would likely be consistent with a BLM VRM classification Class 5.

3.12.2 SITE INFRASTRUCTURE

Baseline Characteristics. Extensive infrastructures exist to support individual reactor sites as shown by the range of values displayed in Table 3.12.2-1. Approximately one-half of the 72 reactor sites in the United States contain two or three nuclear units. Larger land-use areas associated with plant cooling systems include reservoirs, artificial lakes, and buffer areas. Road infrastructure is needed for personnel access and intersite transportation requirements. Railroad infrastructure is required to support shipments of fuels, spent fuels, and outsized structural components among other items. Some sites are situated on navigable waters.

The reactor sites are located in a regional electric power pool made up of its parent utilities and a number of subregions. These power pools draw their electrical power from a variety of generating sources, as shown in Table 3.12.2-2.

Table 3.12.2-1. Generic Existing Light Water Reactor Site Baseline Characteristics

Characteristics	Site Availability
Transportation	
Roads (km)	5 to 20
Railroads (km)	0 to 12
Electrical	
Energy consumption (MWh /yr)	700,000 to 1,100,000
Peak load (MWe)	96 to 140
Fuel	
Oil (l/yr)	approximately 757,000

Source: ORNL 1995b.

Table 3.12.2-2. Generic Existing Light Water Reactor Site Regional Power Pool Electrical Summary

Characteristics	Energy Production
Type Fuel^a	
Coal	14 to 59%
Nuclear	0 to 39%
Hydro/geothermal	2 to 46%
Oil/gas	<1 to 32%
Other ^b	0 to 30%
Total Annual Production	107,607,000 to 272,155,000 MWh
Total Annual Load	104,621,000 to 293,262,000 MWh
Energy Exported Annually	-45,400,000 to 6,359,000 MWh
Generating Capacity	24,870 to 61,932 MWe
Peak Demand	20,578 to 57,028 MWe
Capacity Margin^c	4,064 to 13,655 MWe

^a Does not total 100 percent due to range at power pools used to estimate the generic site.

^b Includes power from both utility and nonutility sources.

^c Capacity margin is the amount of generating capacity available to provide for scheduled maintenance, emergency outages, system operating requirements, and unforeseen electrical demand.

Source: NERC 1993a.

3.12.3 AIR QUALITY AND NOISE

Meteorology and Climatology. The meteorological and climatological conditions at the representative existing LWR sites in the United States include a wide range of extremes in ambient temperature, wind speed and direction, and precipitation. Therefore, no further description of meteorology and climatology has been provided with respect to a generic site.

Ambient Air Quality. Ambient air quality conditions at the representative existing LWR sites in the United States include a wide range of pollutants and conditions. Table 3.12.3-1 presents the baseline ambient air concentrations for criteria pollutants at a representative existing LWR site. As shown in this table, the existing LWR site is expected to comply with the ambient air quality standards. Some of the existing LWR sites evaluated are located near or within nonattainment areas for PM₁₀, O₃, and CO.

Table 3.12.3-1. Comparison of Baseline Ambient Air Concentrations With Most Stringent Applicable Regulations or Guidelines at the Generic Existing Light Water Reactor Site

Pollutant	Averaging Time	Most Stringent Regulation or Guideline ^a (µg/m ³)	Baseline Concentration (µg/m ³)
Criteria Pollutants			
Carbon monoxide	8-hour	10,000	<0.01
	1-hour	40,000	<0.01
Lead	Calendar Quarter	1.5	^b
Nitrogen dioxide	Annual	100	0.05
Ozone	1-hour	235	^c
Particulate matter less than or equal to 10 microns in diameter	Annual	50	<0.01
	24-hour	150	0.015
Sulfur dioxide	Annual	80	0.04
	24-hour	365	0.15
	3-hour	1,300	0.35
Hazardous and Other Toxic Compounds			
No sources indicated			

^a The Federal standards are presented.

^b No sources indicated.

^c Ozone, as a criteria pollutant, is not directly emitted nor monitored by the sites. See Section 4.1.3 for a discussion of ozone-related issues.

Source: 40 CFR 50; TVA 1974b.

Noise. Specific existing noise sources and characteristics of a generic existing LWR site cannot be described. However, it is expected that the area near such a site would be essentially rural in character and would have typically low background sound levels. Typical DNL in the range 35 to 50 dBA can be expected for such a rural location (EPA 1974a:B-4) where noise sources may include wind, insect activity, aircraft, and agricultural activity. Existing industrial noise sources and traffic noise at the site would result in higher background noise levels near the site and along site access routes.

3.12.4 WATER RESOURCES

Surface Water. Major surface water features in the generic existing LWR site area could range from a large navigable river to a large lake. The average flow rate of these water bodies could range from 28 to 3,360 m³/s (989 to 118,658 ft³/s). Other surface water features could include large ponds and/or small streams bordering the site.

Stormwater control retention/drainage ponds could be present at the site. These ponds would probably discharge to the nearest large surface water body.

Surface Water Quality. In the vicinity of the generic existing LWR site, the surface water bodies could range from being unclassified to classified as fresh water suitable for public and food processing water supply. The range of concentrations of typical surface water quality parameters that could be encountered at generic sites was presented in Table 3.10.4–1. High nutrient loads, low dissolved oxygen, and moderately high bacteria count could be encountered in the nearby large surface water body.

The generic existing LWR site would have an NPDES permit(s) that would dictate the acceptable levels of specific parameters in the liquid effluents that would be discharged to a nearby surface water body.

Surface Water Rights and Permits. Surface water rights concerning the large water body near the existing LWR site would involve non-impairment of designated uses.

Groundwater. The near-surface aquifer beneath the generic existing LWR site would occur under unconfined conditions and could range in average thickness from approximately 5 to 55 m (16 to 180 ft). Depth to groundwater could range from near the ground surface to 12 m (39 ft). The aquifer material could range from glacial drift to saprolite. In general, the generic existing LWR site would obtain groundwater from a confined aquifer underlying the near-surface aquifer. The confined aquifer would have an abundant supply of groundwater, although groundwater levels could be declining in the area. Water quality could range from good to fair.

Recharge to the near-surface aquifer would be primarily from rainfall and would occur in areas located from near the site to more than 16 km (10 mi) away from the site. Groundwater flow would typically be from these recharge areas towards the major surface water feature.

In areas surrounding the typical generic existing LWR site, groundwater would be used for domestic, industrial, agricultural, and municipal supply purposes. The classification of the aquifer beneath the site would be a Class II aquifer (that is, currently being used or a potential source of drinking water).

Groundwater Quality. Groundwater quality of the near-surface aquifer in the site area would range from good to fair. The range of hydraulic characteristics of the groundwater that might be encountered is presented in Table 3.10.4–2.

Groundwater Availability, Use, and Rights. Groundwater rights concerning the aquifer(s) near the generic existing LWR site could range from having potential for local restrictions on pumping to a reasonable use doctrine concerning neighboring landowners water availability.

3.12.5 GEOLOGY AND SOILS

Geology. The physiography of an existing LWR site could range from a flat nearly featureless plain to a highly dissected plain of arid to humid environments. The geology could range from alluvium to thick sequences of unconsolidated marine sediments, glaciofluvial material, and crystalline and sedimentary bedrock. These materials could range in age from Cenozoic to Precambrian (recent to over 600 million years).

The existing LWR sites could be located in Seismic Zones 0 to 2, which suggests there could be no to moderate levels of damage in the event of an earthquake (Figure 3.2.5-1). The geologic settings for Seismic Zones 0 to 2 considered for the existing LWR sites have histories of seismic activity that range from low to high. The location of the nearest capable fault could range from within the site boundaries to 350 km (217 mi) away from existing LWR sites. The nearest known epicenter of a damaging earthquake (MMI of VII or greater [Table 3.2.5-1]) could be approximately 350 km (217 mi) from existing LWR sites.

The existing LWR sites are not located within a region of active volcanism; however, an existing LWR site could be located within 164 km (102 mi) of a volcano.

Soils. The existing LWR sites could be located where the predominant soil types are loamy clays to gravel silty loams. These soils range from moderate to well drained soils. The erosion potential could range from minor to severe in those areas with slopes greater than 25 percent and which have been eroded in the past. The soils shrink-swell potential could range from low to severe, which is acceptable for standard construction techniques, depending upon the engineering controls employed. Wind erosion potential ranges from minor to severe.

3.12.6 BIOLOGICAL RESOURCES

Generic existing LWR sites are located within a number of the principal vegetation types. Vegetation types characteristic of the representative generic existing LWR sites used for this analysis include deciduous forest, grassland, desert, and southeast evergreen forest. Biological resources found within these vegetation types are described in Section 3.10.6 and 3.11.6. At a given site, biological resources could vary from those typically associated with the principal vegetation type of the area due to a variety of factors, including previous disturbance by man.

3.12.7 CULTURAL AND PALEONTOLOGICAL RESOURCES

Prehistoric Resources. Prehistoric resources in the vicinity of the existing LWR site may include sites, districts, or isolated artifacts. Archaeological sites may represent occupation during the Archaic through later prehistoric periods and can include hunting and butchering sites, cemeteries, campsites, and tool manufacturing areas. They may yield artifacts such as stone tools and associated manufacturing debris, and ceramic potsherds. Some sites may have been determined eligible for inclusion on the NRHP by the SHPO. Prehistoric resources are most likely to be affected by ground disturbance. No impacts to prehistoric resources are anticipated because this alternative does not involve new facility construction.

Historic Resources. Historic resources may include cemeteries, remains of commercial or residential structures, or standing structures. Some sites may be eligible for inclusion on the NRHP.

Native American Resources. To date, no Native American resources have been identified at the generic existing LWR site, but they may exist. Such resources can include cemeteries, geological or geographic elements (such as mountains or creeks), certain species of animals or plants, architectural structures (such as pueblos), battlefields, or trails. Such resources are objects or areas that are important to Native American groups for religious or historical reasons. There also may be visual impacts to Native American resources.

Paleontological Resources. To date, no paleontological resources have been identified at the generic existing LWR site. However, some fossil-bearing strata may exist that contain rare fossils or fossil assemblages.

3.12.8 SOCIOECONOMICS

The generic existing LWR site could potentially affect the socioeconomic environment of a given REA or ROI. The characteristics of the REA, ROI, and community are dependent upon geographic location. For employment and income, the economic area would be based upon industry interaction and linkages in the region. The anticipated residential distribution of project-related employees and their families would determine the ROI. This ROI would contain all principal jurisdictions and school districts likely to be affected by the proposed activity.

Because specific commercial LWR sites have not been proposed for burning MOX fuel, representative sites have been used to describe the affected environment. Five existing reactors encompassing four location types were used as representative sites to develop a range of conditions for discussion in this section. The first two communities, Sites A and B, are small communities tied to large metropolitan areas. Site C is a medium-size community near a large metropolitan area. The fourth site, Site D, is a medium-size community located in an urbanized area.

Small communities were characterized in Section 3.11.8. Medium-size communities and the vulnerability or susceptibility of a local community to changes in the economic base were described in Section 3.10.8. However, the specific communities discussed in this section are different from those discussed in Section 3.11.8.

Socioeconomic characteristics described for the generic existing LWR site include employment and local economy, population and housing, and local transportation. Site A, which had a 1992 population of 2,604, was located about 160 km (100 mi) from a large metropolitan area. Site B, with a 1992 population of 5,236, was located approximately 8 km (5 mi) from a small community and approximately 64 km (40 mi) from a large metropolitan area. Site C, with a 1992 population of 44,384, was located approximately 16 km (10 mi) from a medium-size community and approximately 48 km (29.8 mi) from a large metropolitan area. Site D, a medium-size community, had a 1992 population of 34,201 and a total urban population of more than 100,000. Statistics for employment and local economy were based on the REA for each site. Statistics for the remaining socioeconomic characteristics were based on the sites' ROIs.

Regional Economy Characteristics. Employment and regional economy statistics for each representative site's REA are discussed in this section and displayed in Figure 3.12.8-1. Between 1980 and 1990, the civilian labor force in the REA encompassing Site A increased 7.7 percent to the 1990 level of 4,811,800, and for Site B increased 49.6 percent to the 1990 level of 1,162,300. The civilian labor force for Site C, located near a large metropolitan area, increased 21.9 percent to the 1990 level of 862,500. The civilian labor force for Site D, located in an urbanized area, increased 9.9 percent to 254,800 persons. The 1994 unemployment rates in the two small communities' (A and B) REAs were 5.6 percent and 5.2 percent, respectively. Sites C and D had unemployment of 4.3 percent and 9.1 percent, respectively. The 1993 per capita incomes were \$23,634 at Site A and \$19,497 at Site B. Sites C and D had per capita incomes of \$19,489 and \$18,501, respectively.

Figure 3.12.8-1 displays the division of employment involving farming, nonfarming, and government sectors for each typical site. For the two small representative communities, the portions of total employment involving farming in the REAs were about 1 percent. Governmental activities for Sites A and B represented about 12 percent and 14 percent, respectively. Manufacturing was 16 percent of the total employment for site A and 10 percent for site B. Retail trade accounted for 16 percent and 18 percent of the total sector employment for Sites A and B, respectively. Service activities represented a 30-percent share of the total employment for Sites A and B.

For Sites C and D, the portion of total employment was about 1 percent and 12 percent for farming and 11 and 15 percent for governmental activities, respectively. The nonfarm private sector activities of retail trade and services were 16 and 22 percent of total employment, respectively, for Site C and 16 and 26 percent,

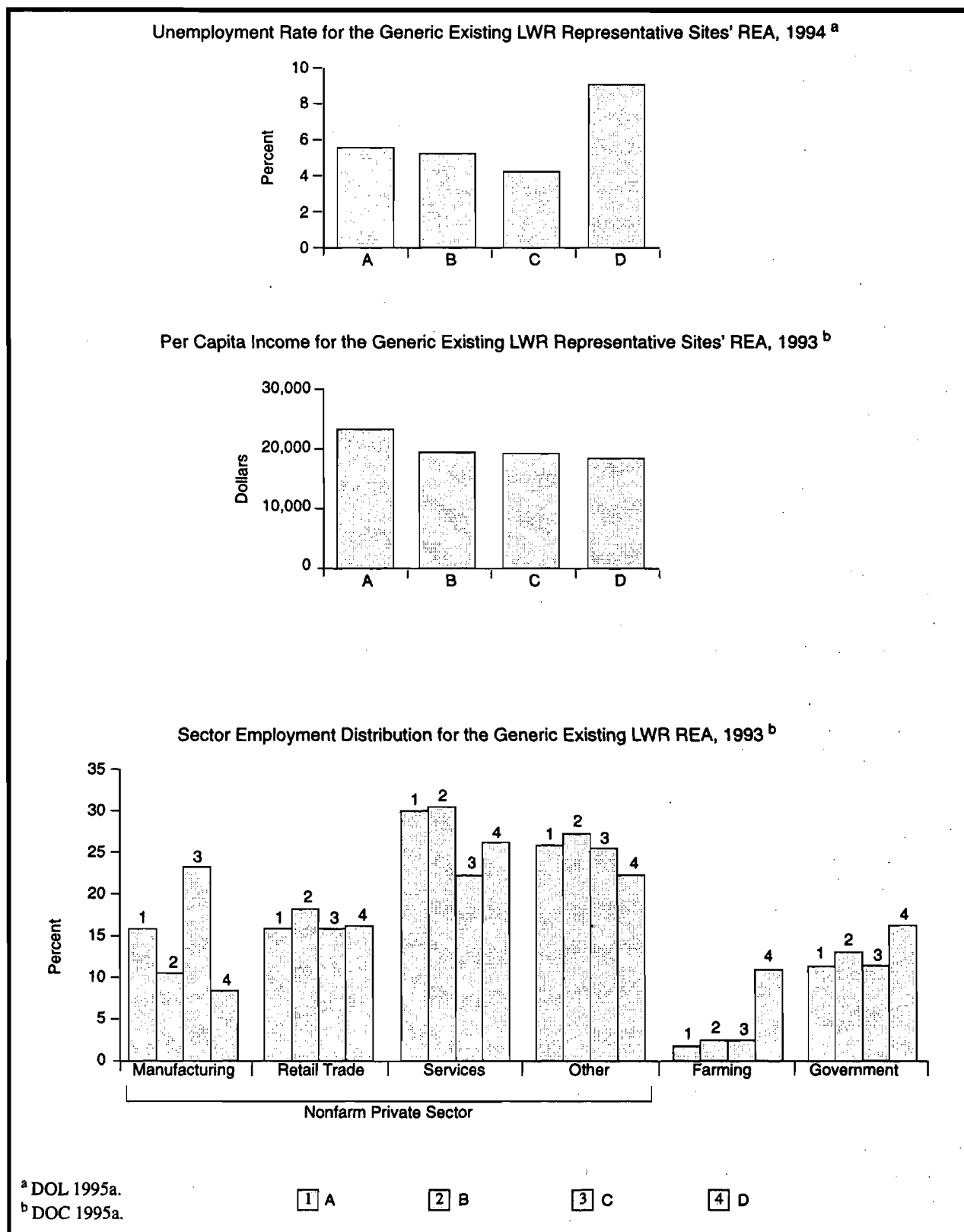


Figure 3.12.8-1. Employment and Local Economy for the Generic Existing Light Water Reactor Representative Sites' Regional Economic Area.

respectively, for Site D. Employments for manufacturing were 23 and 8 percent of total employment for Sites C and D, respectively.

Population and Housing. Population and housing trends in the representative ROIs are presented in Figure 3.12.8–2. The ROI population increase for the two small communities, A and B, between 1980 and 1994 were 6.4 (average annual increase of 0.5 percent) and 54.6 (average annual increase of 3.9 percent) percent, respectively. The number of housing units in the ROI increased 8.9 percent for Site A and 55.8 percent for Site B between 1980 and 1990. The 1990 ROI homeowner vacancy rates were 1.1 and 3.9 percent, while the renter vacancy rates were 5.9 and 16.4 percent for Sites A and B, respectively.

The ROIs surrounding Sites C and D experienced an 31.8-percent (average annual increase of 2.3 percent) and 19.8-percent (average annual increase of 1.4 percent) increase in population, between 1980 and 1994, and a 32.7- and 5.4-percent increase, respectively, in the number of housing units between 1980 and 1990. The 1990 homeowner and renter vacancy rates were 2.0 and 8.9 percent for Site C and 1.3 and 5.6 percent for Site D.

Community Services and Local Transportation. These characteristics are dependent upon a geographic location. The ROI would determine all principal jurisdictions and school districts likely to be affected by the proposed activity. Local transportation would be the existing principal road, air, and rail networks required to support the project activities.

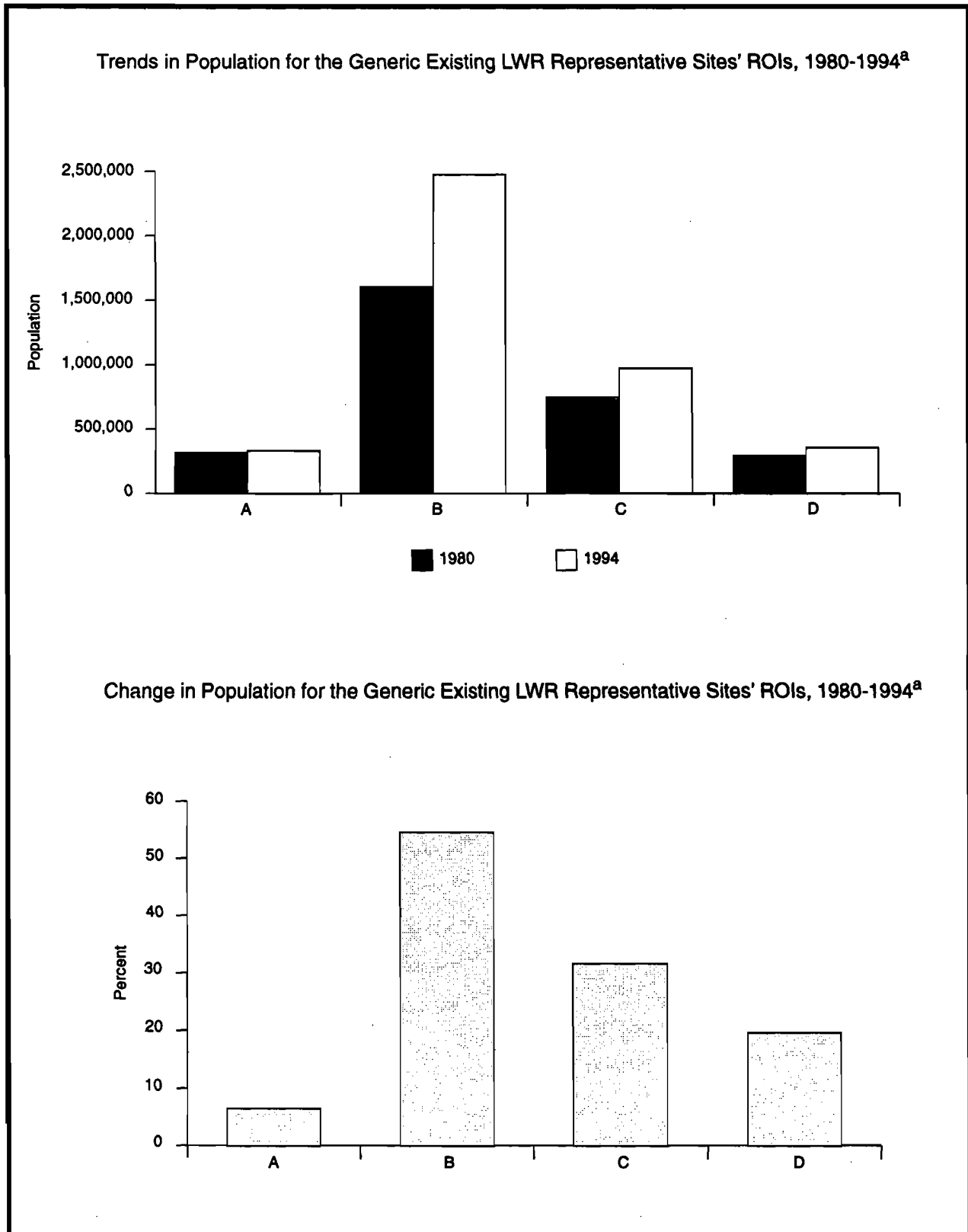


Figure 3.12.8-2. Population and Housing for the Generic Existing Light Water Reactor Representative Sites' Region of Influence.

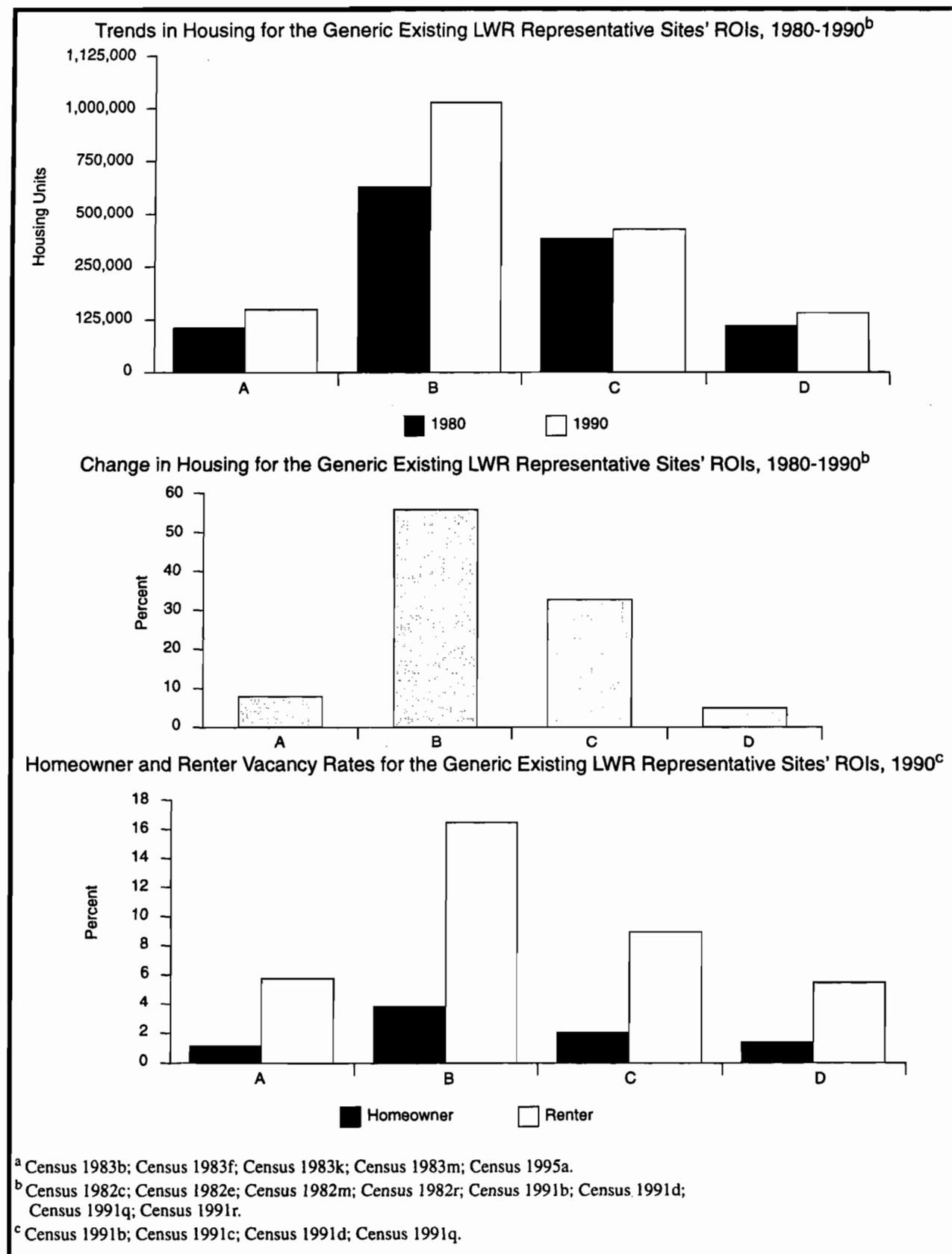


Figure 3.12.8-2. Population and Housing for the Generic Existing Light Water Reactor Representative Sites' Region of Influence—Continued.

3.12.9 PUBLIC AND OCCUPATIONAL HEALTH AND SAFETY

Radiation Environment. Major sources and levels of background radiation exposure to individuals in the vicinity of the generic existing LWR site are shown on Table 3.12.9–1. Annual background radiation doses to individuals are expected to remain constant over time. The total dose to the population size changes as the population size changes. Background radiation doses are unrelated to LWR site operations.

Table 3.12.9–1. Sources of Radiation Exposure to Individuals in the Vicinity, Unrelated to Operation at the Generic Existing Light Water Reactor Site

Source	Effective Dose Equivalent (mrem/yr)
Natural Background Radiation	
Cosmic radiation ^a	27 to 29
Cosmogenic radiation ^b	1
External terrestrial radiation ^a	29 to 30
Internal terrestrial radiation ^b	39
Radon in homes (inhaled) ^b	200
Other Background Radiation^b	
Diagnostic x rays and nuclear medicine	53
Weapons test fallout	<1
Air travel	1
Consumer and industrial products	10
Total	361 to 364

^a Based on information given in EPA 1981b.

^b NCRP 1987a.

Note: Value for radon is an average for the United States.

Releases of radionuclides to the environment from generic existing LWR site operations provide another source of radiation exposure to individuals in the vicinity of generic existing LWR sites. Types and quantities of radionuclides released from generic existing LWR site operations in 1994 are listed in the 1994 radiological effluent release reports for the reference sites. The doses to the public resulting from these releases are presented in Table 3.12.9–2. These doses fall within radiological guidelines and limits (10 CFR 50, Appendix I and 40 CFR 190) and are small in comparison to background radiation.

Based on a risk estimator of 500 cancer deaths per 1 million person-rem to the public (Section M.2.1.2), the fatal cancer risk to the maximally exposed member of the public due to radiological releases from operations at the generic existing LWR site in 1994 is estimated to range from 3.9×10^{-9} to 7.0×10^{-7} . That is, the estimated probability of this person dying of cancer at some point in the future from radiation exposure associated with 1 year of LWR site operations ranges from about 4 in 1 billion to 7 in 10 million. (Note that it takes several to many years from the time of exposure to radiation for a cancer to manifest itself.)

Based on the same risk estimator, a range of 1.0×10^{-5} to 6.7×10^{-3} excess fatal cancers is projected in the population living within 80 km (50 mi) of the generic existing LWR site from normal operations in 1994. To place these numbers into perspective, they can be compared with the numbers of fatal cancers expected in these populations from all causes. The 1990 mortality rate associated with cancer for the entire U.S. population was 0.2 percent per year (Almanac 1993a: 839). Based on this mortality rate, the number of fatal cancers expected during 1994 from all causes in the population living within 80 km (50 mi) of the generic existing LWR site

Table 3.12.9-2. Radiation Doses to the Public From Normal Operation at the Generic Existing Light Water Reactor Site in 1994 (Committed Effective Dose Equivalent)

Members of the General Public	Atmospheric Releases		Liquid Releases		Total	
	Standard ^a	Actual	Standard ^a	Actual	Standard ^a	Actual ^b
Maximally exposed individual (mrem)	5	1.3×10^{-3} to 1.10	3 per reactor	0 to 0.29	25	7.8×10^{-3} to 1.39
Population within 80 km ^c (person-rem)	None	0.016 to 13.3	None	0 to 1.28	None	0.020 to 13.3
Average individual within 80 km (mrem) ^d	None	6.3×10^{-5} to 6.8×10^{-3}	None	0 to 8.9×10^{-4}	None	7.9×10^{-5} to 6.8×10^{-3}

^a The standards for individuals are given in 10 CFR 50 Appendix I and 40 CFR 190. As discussed in Appendix I of 10 CFR 50, the 5 mrem/yr value is an airborne emission guideline and the 3 mrem/yr per reactor value is a liquid release guideline. Meeting these guideline values serves as a numerical demonstration that doses are as low as is reasonably achievable. The total dose of 25 mrem/yr is the limit from all pathways combined as given in 40 CFR 190.

^b Totals cannot be obtained by summing the atmospheric and liquid release components since these component entries can be for different reactor sites.

^c This population ranges from 252,000 to 1,960,000.

^d Obtained by dividing the population dose by the number of people living within 80 km of the site.

Source: HNUS 1996a.

ranged from 505 to 3,920. These numbers of expected fatal cancers are much higher than the estimated range of 1.0×10^{-5} to 6.7×10^{-3} fatal cancers that could result from operations at the generic existing LWR site in 1994.

At the generic existing LWR site, workers receive the same dose as the general public from background radiation but also receive an additional dose from working at the site. Table 3.12.9-3 presents the range of the average worker, maximally exposed worker, and total worker dose from operations at the generic existing LWR site in 1993. These doses fall within radiological regulatory limits (10 CFR 20). Based on a risk estimator of 400 fatal cancers per 1 million person-rem among workers (Section M.2.1.2), the number of excess fatal cancers to generic existing LWR site workers from operations in 1993 is estimated to range from 0.16 to 0.34.

A more detailed presentation of the radiation environment, including background exposures and radiological releases and doses, is presented in the reference sites' environmental reports and environmental monitoring reports. The concentrations of radioactivity in various environmental media (including air, water, and soil) in the regions of the generic existing LWR site (onsite and offsite) are also presented in those documents.

Chemical Environment. The background chemical environment important to human health consists of the atmosphere, which may contain hazardous chemicals that can be inhaled; drinking water, which may contain hazardous chemicals that can be ingested; and other environmental media with which people may come in contact (for example, surface waters during swimming and soil through direct contact or via the food pathway). The baseline data for assessing potential health impacts from the chemical environment are those presented in Section 3.12.3.

Effective administrative and design controls that decrease hazardous chemical releases to the environment and help achieve compliance with permit requirements (for example, air emissions and NPDES permit requirements) contribute toward minimizing potential health impacts to the public. The effectiveness of these controls is verified through the use of monitoring information and inspection of mitigation measures. Health impacts to the public may occur during normal operations at generic existing LWR sites via inhalation of air containing hazardous chemicals released to the atmosphere by site operations. Risks to public health from other

Table 3.12.9-3. Doses to Workers From Normal Operation at the Generic Existing Light Water Reactor Site in 1993 (Committed Effective Dose Equivalent)

Occupational Personnel	Onsite Releases and Direct Radiation	
	Standard ^a	Actual
Average worker (mrem)	ALARA	114 to 322
Maximally exposed worker (mrem)	5,000	2,000 to 3,000
Total workers ^b (person-rem)	ALARA	396 to 854

^a NRC's goal is to maintain radiological exposure as low as reasonably achievable.

^b The number of badged workers in 1993 ranged from 2,650 to 4,370.

Source: 10 CFR 20; NRC 1995b.

possible pathways, such as ingestion of contaminated drinking water or direct exposure, are low relative to the inhalation pathway.

A discussion of ambient air quality is included in Section 3.12.3. As stated in that section, air quality is expected to be in compliance with applicable standards. Information about estimating health impacts from hazardous chemicals is presented in Section M.3.

Exposure pathways for generic existing LWR site workers during normal operation may include inhaling the workplace atmosphere and direct contact with hazardous materials associated with work assignments. Occupational exposure varies from facility to facility and from worker to worker, and available information is not sufficient to allow a meaningful estimation and summation of these impacts. However, workers are protected from hazards specific to the workplace through appropriate training, protective equipment, monitoring, and management controls. At the generic existing LWR site, workers are also protected by adherence to OSHA and EPA standards that limit workplace atmospheric and drinking water concentrations of potentially hazardous chemicals. Appropriate monitoring that reflects the frequency and amounts of chemicals utilized in the operational processes, ensures that these standards are not exceeded. Worker health conditions at the generic existing LWR site are expected to be substantially better than required by the standards.

Health Effects Studies. Specific locations for the generic existing LWR must be designated before any reviews of epidemiologic studies in the areas can be conducted.

Accident History. Commercial LWR's that utilize uranium fuel have been in operation in the United States for many years. Accident information for these reactors, where applicable, can be found in documentation available from the NRC. Estimates of potential accidents and their consequences can also be found in safety analysis reports and probabilistic risk assessments prepared by the reactor owners and filed with the NRC. There are no domestic commercial reactors that utilize MOX fuel and consequently there is no information available regarding England accident history for MOX fueled reactors.

Emergency Preparedness. The generic existing LWR site has an emergency management program that would be activated in the event of an accident. The programs are compatible with the other Federal, State, and local plans and are thoroughly coordinated with all interested groups. Programs would be modified, if necessary, to accommodate MOX fueled reactor operations.

3.12.10 WASTE MANAGEMENT

Because of the increased disposal costs for LLW, utility companies have undertaken major volume reduction and waste minimization efforts. These efforts include segregation, decontamination, minimizing the exposure of materials and tools to the contaminated environment, and sorting. Compaction, consolidation, and the monitoring of waste streams to reduce the volume of LLW requiring storage and to lessen the exposure of routine equipment to the reactor environment have been the most effective volume reduction strategies. Between 1981 and 1985 there was a 48-percent decrease in LLW volumes from commercial pressurized LWRs. Current industry-wide volume reduction practices include ultra-high pressure compaction of waste drums, incineration of waste oils and resins, mobile thin-film evaporation, waste crystallization, and asphalt solidification of resins and sludges (NRC 1996b:6-40).

Nuclear power plants currently operating typically have waste minimization programs in place to minimize both the volume and cost impact of waste generation. In existing operating plants, a number of the design considerations that affect the plant waste streams are already in place, and improvements in waste management are continually being implemented. Waste minimization steps include more economical use of disposables or elimination of disposables in favor of recyclables. Process improvements aimed at more efficient use of ion exchange resins and reductions of waste streams from the waste processes are being implemented. In general, wastes generated by operating plants have been decreasing in recent years. The amount of waste generation is reported by each utility on a quarterly basis. Table 3.12.10-1 provides a range of waste volumes based on site-specific data from existing representative LWRs.

Spent Nuclear Fuel. After removal from the reactor, spent nuclear fuel is stored in racks in pools to isolate it from the environment and to allow the fuel rods to cool. Current plans call for spent nuclear fuel to be ultimately disposed of in a deep-geological repository. Because of the delay in siting the repository and interim monitored retrievable storage facilities, utility companies have been faced with the rapid filling of their spent fuel pools. The utility companies have been expanding pool storage, building above-ground dry storage, using longer fuel burnup to reduce the amount of spent fuel requiring interim storage, and shipping the spent nuclear fuel to other plants (NRC 1996b:6-70). When moved to another location, spent nuclear fuel is shipped in casks that are designed to withstand severe transportation accidents and are resistant to small-arms fire and HE detonations (NRC 1996b:6-34).

The average number of spent nuclear fuel assemblies discharged ranges from 64 to 88 for the 8 PWR and 187 to 191 for the 4 BWR existing plants used in the analysis. Licensed spent fuel pool storage capacity (number of assemblies) ranges from 756 to 1,542 for the 8 PWR plants, and 2,040 to 4,020 for the 4 BWR plants.

High-Level Waste. The generic existing LWR would not generate or manage HLW.

Transuranic Waste. The generic existing LWR would not generate or manage TRU waste.

Low-Level Waste. Liquid LLW generated in pressurized LWRs could be classified as either clean waste, dirty waste, turbine building floor drain water, or steam generator blowdown. Clean wastes come from equipment leaks and drains, certain valve and pump seal leakoffs not collected in the reactor coolant drain tank, and other aerated leakage sources. Primary coolant is also considered a clean waste. Liquid wastes collected in the containment building sump, auxiliary building sumps and drains, laboratory drains, sample station drains, and other miscellaneous floor drains are termed dirty wastes because of their moderate conductivity. Clean and dirty wastes will have variable radioactivity content. Detergent wastes, which consist of laundry wastes and personnel and equipment decontamination wastes, normally have a low radioactivity content. Turbine building floor drain water usually exhibits high conductivity with low radionuclide content. Depending on the amount of primary-to-secondary leakage, steam generator blowdown could have relatively high concentrations of radionuclides. The chemical and radionuclide content of the waste would determine the type and degree of treatment before

Table 3.12.10-1. Existing Light Water Reactor Site Waste Management Characteristics

Characteristic	BWR Range	BWR Average	PWR Range	PWR Average	All Plants Average	All Plants Low	All Plants High
LLW shipped (m ³ /yr)	367.21 to 936.25	572.61	57.04 to 636.85	178.22	309.69	57.04	936.25
Number LLW shipments/year	39.50 to 108.25	62.84	6.00 to 31.00	16.17	31.73	6.00	108.25
Stored mixed waste/ 1000 MWe (m ³ /yr)	Not reported	Not reported	Not reported	Not reported	101.90	Not reported	Not reported
Licensed spent fuel pool storage capacity (number of assemblies)	2,040 to 4,020	3,176	756 to 1,542	1,214	1,868	756	4,020
Average number of assemblies discharged	187 to 191	190	64 to 88	72	111	64	191

Source: ORNL 1995b.

storage for reuse or discharge to the environment. Operating plants have steadily increased the degree of processing, storing, and recycling of liquid radioactive waste (NRC 1996b:2-5).

Solid LLW is generated by the removal of radionuclides from the liquid radioactive waste streams, the filtration of airborne gaseous emissions, and the removal of contaminated material from various reactor areas. The concentrated liquids, filter sludges, waste oils, and other liquid sources are segregated by type, flushed to storage tanks, stabilized for packaging in a solid form by dewatering, and slurried into 0.2 m³ (0.3 yd³) steel drums. Other solid LLW consists of spent HEPA filters and wastes from plant modifications and routine maintenance activities such as contaminated protective clothing, paper, rags, glassware, compactible and noncompactible trash, and non-fuel irradiated reactor components and equipment. Tools and other material exposed to the reactor environment would also be considered solid LLW. Compactible solid LLW is taken to an offsite or onsite volume reduction facility before disposal. Solid LLW is stored in shielded prefabricated steel buildings or other facilities until suitable for disposal at an approved LLW disposal facility (NRC 1991a:2-15).

Low-level waste from BWRs primarily consists of concentrated waste from the reactor water cleanup and condensate demineralizer systems and waste generated during maintenance activities (for example, protective clothing, replaced equipment, and so forth). The average annual (1988 to 1992) volume of LLW shipped from a typical BWR unit ranges from 367 to 936 m³/yr (480 to 1,224 yd³/yr). The average annual (1988 to 1992) volume of LLW shipped from a typical PWR unit ranges from 57 to 637 m³/yr (75 to 833 yd³/yr). For 1993 and 1994, the per-unit volume of waste for all domestic BWRs has fallen to less than 200 m³/yr, 18 percent under the 1995 industry goal of 245 m³/yr. The average number of LLW shipments/year from a typical BWR unit ranges from 40 to 108. The average number of LLW shipments/year from a typical PWR unit ranges from 6 to 31. For 1993 and 1994, the per-unit volume of waste for all domestic PWRs has fallen to less than 50 m³/yr (65.4 yd³/yr), 45 percent under the 1995 industry goal of 110 m³/yr (144 yd³/yr) (ORNL 1995b:B-8).

Mixed Low-Level Waste. Mixed waste generated by a nuclear power plant covers a broad spectrum of waste types. The vast majority of mixed waste in storage at nuclear plants is chlorinated fluorocarbons and waste oil. Mixed LLW is stored onsite until treatment and disposal is available at an offsite RCRA-permitted facility. Because of the occupational exposure from testing radioactive wastes to determine if they are chemically hazardous, the utilities have been looking at ways to eliminate, or at least minimize, the generation of mixed wastes. These efforts include removing and separating hazardous constituents from radioactive streams by remote methods; minimizing the use of solvents exposed to the reactor environment; relying on substitute processes; and recycling and reusing cleaning materials, resins, and waste oils (NRC 1996b:6-66). Stored mixed LLW/1,000 MWe averages 102 m³/yr (133 yd³/yr) for all 12 existing plants studied.

Hazardous Waste. Hazardous wastes are generated from nonradioactive materials such as wipes contaminated with oils, lubricants, and cleaning solvents that are used outside the reactor environment. Hazardous wastes are packaged and shipped to offsite RCRA-permitted treatment and disposal facilities.

Nonhazardous Waste. Nonhazardous wastes include boiler blowdown, water treatment wastes, boiler metal cleaning wastes, floor and yard drain wastes, stormwater runoff, and sewage wastes. Depending on the design of the individual reactor, other small volumes of wastewater are released from other plant systems or combined with the cooling water discharges. Sanitary wastes that cannot be processed by onsite waste treatment systems are collected by independent contractors and trucked to offsite treatment facilities (NRC 1996b:6-86).

3.13 PARTIALLY COMPLETED REACTOR SITE

For this PEIS, the approach used to define the environmental setting for a partially completed reactor site was to use data from a representative site. Consequently, the environmental resource/issue areas are described in a general sense; not for a specific site.

The representative site used in this case is the partially completed Bellefonte Nuclear Plant, located in northeast Alabama along the Tennessee River. Principal structures include two reactor containment buildings, a turbine building, an auxiliary building, a condenser circulating water pumping station, two diesel generator buildings, a river intake pumping station, natural draft cooling towers, a transformer yard, 500-kV and 161-kV switchyards, and a sewage treatment facility.

3.13.1 LAND RESOURCES

For the partially completed reactor site, the representative environmental setting attributes for land use and visual resources are shown in Table 3.13.1-1.

Table 3.13.1-1. Land Resources Attributes of the Partially Completed Reactor Site

Land Use Attributes	
Land Area	600 ha ^a
Land Ownership	Public
Existing Land Use	
Onsite	Industrial
Offsite	Predominately forest and agricultural use; some urban/developed
Land Use Compatibility	Likely
Plans, Policies, and Controls	
Jurisdiction	DOE; other Federal; State; local
Enforcement	Lax to stringent
Conformance	Likely
Visual Resource Attributes	
Landscape Character	
Site	Flat valley; adjacent to large water body
Viewshed	Urban-industrial nodes; low-density residential; agricultural; and forest
Visual Resource	
Sensitivity Level	High
Distance Zones	Foreground, middleground, background, and seldom-seen
BLM VRM Class	5 (developed land)
Degree of Contrast	Weak to none

^a Land area already dedicated.

Source: TVA 1974a; TVA 1974b; TVA 1995b:1.

Land Use. The partially completed reactor site consists of approximately 600 ha (1,500 acres) of land. However, this land area has already been dedicated; additional land area is not required to complete construction. Land use within the ROI is comprised of predominately forest and agricultural use, with some urban and developed land. Many communities adjacent to the site have corporate limits far exceeding actual developed areas and could accommodate additional development. The nearest town is located approximately 5 km (3 mi) from the site.

Completion of site development for industrial purposes would conform with the proposed land use of the site and its vicinity (urban and industrial development) as designated by the appropriate governmental plans, policies, and controls, and be compatible with adjacent land uses.

Visual Resources. The visual landscape of the partially completed reactor site is characterized by a flat valley adjacent to a reservoir and a river. The visual landscape of the site reflects that of an industrialized facility. The viewshed includes hilly land with urban-industrial nodes surrounded by low-density residential development scattered among agricultural uses and forest lands.

As discussed in Section 3.1.1, a visual resource inventory is composed of three factors: VRM classification, distance zones, and sensitivity levels. Distance zones with viewpoints include foreground, middleground,

background, and seldom-seen. Due to the site location adjacent to a large body of water, the immediate vicinity is likely to be subject to high user volumes associated with recreational use. Because of the proximity to urban development and a high-use recreational area, it is likely that the facilities would be visible from viewpoints with high sensitivity levels. However, since the partially completed reactor site represents an existing condition, contrasts created by new development are considered weak to none. The developed areas of the site are consistent with a VRM classification Class 5.

3.13.2 SITE INFRASTRUCTURE

Baseline Characteristics. The partially completed reactor site has the infrastructure shown in Table 3.13.2–1. The road infrastructure would be needed primarily for personnel access to the site. The railroad infrastructure is required for spent fuel shipments and oversized structural components. The site is situated on a navigable river with a small docking facility to accommodate barge traffic.

Table 3.13.2–1. Partially Completed Reactor Site Baseline Characteristics

Characteristics	Site Availability
Transportation	
Roads (km)	8
Railroads (km)	6
Electrical	
Energy consumption (MWh/yr)	1,100,000
Peak load (MWe)	140
Fuel	
Oil (l/yr)	757,000

Source: LLNL 1996g.

The sub-regional electric power pool for the site has the characteristics depicted in Table 3.13.2–2.

Table 3.13.2–2. Partially Completed Reactor Site Sub-Regional Power Pool Electrical Summary

Characteristics	Energy Production
Type Fuel^a	
Coal	49%
Nuclear	39%
Hydro/geothermal	11%
Oil/gas	<1%
Other ^b	0%
Total Annual Production	159,842,000 MWh
Total Annual Load	156,987,000 MWh
Energy Exported Annually^c	2,407,000 MWh
Generating Capacity	33,370 MWe
Peak Demand	28,127 MWe
Capacity Margin^d	4,550 MWe

^a Percentage does not total 100 percent due to rounding.

^b Includes power from both utility and nonutility sources.

^c Energy exported is not the difference of production and load due to system losses and pumped storage.

^d Capacity margin is the amount of generating capacity available to provide for scheduled maintenance, emergency outages, system operating requirements, and unforeseen electrical demand.

Source: NERC 1993a.

3.13.3 AIR QUALITY AND NOISE

Meteorology and Climatology. The climate at the representative partially completed reactor site and the surrounding region is characterized as temperate, with warm, humid summers and cool, variable winds. The average annual temperature is 15.7 °C (60.3 °F); average daily temperatures range from a minimum of -1.6 °C (29.2 °F) in January to a maximum of 31.7 °C (89.0 °F) in July (NOAA 1994c:3). The average annual precipitation is approximately 145.3 cm (57.2 in). Higher frequencies of winds are from the southeast, southwest, and northwest (TVA 1974b:1.2-7).

Ambient Air Quality. Ambient air quality conditions at the representative partially completed reactor site were reviewed. The site is located in an area that has been designated attainment with the NAAQS. There is no PSD Class I areas in the vicinity of the site. The site is expected to comply with the ambient air quality standards.

Noise. [Text deleted.] The area near the representative partially completed reactor site is rural in character and is expected to have typically low background sound levels. Typical DNL in the range of 35 to 50 dBA could be expected for such a rural location (EPA 1974a:B-4) where noise sources would include wind, insect activity, aircraft, and agricultural activity.

3.13.4 WATER RESOURCES

Surface Water. Major surface water features at the partially completed reactor site include a large navigable river that has been dammed to create a reservoir with a surface area of about 275 km² (106 mi²) and a total volume of water of approximately 1.2 trillion l (317 billion gal). Average flow at the site is approximately 89 billion liters/day (23.5 billion gal/day). Other surface water features include small streams bordering the site.

Stormwater control retention/drainage ponds are present at the facility. These ponds discharge into the reservoir via Town Creek.

Surface Water Quality. The surface water body in the vicinity of the partially completed reactor site is classified as fresh water suitable for the following: primary and secondary contact recreation; a source of drinking water, after conventional treatment in accordance with State and local requirements; fishing and the survival and propagation of a balanced indigenous aquatic community of flora and fauna; and industrial and agricultural uses. The range of concentrations of typical surface water quality parameters at the site are presented in Table 3.10.4-1.

Surface Water Rights and Permits. Surface water rights concerning the large water body near the partially completed reactor site involve non-impairment of designated uses.

Groundwater. The near-surface aquifer beneath the site occurs under unconfined conditions. Typical aquifer material is highly weathered sedimentary bedrock overlying slightly fractured bedrock with no evidence of major solution channels.

Although the reservoir near the site supplies most of the potable water to nearby users, both private and public uses of groundwater occur in areas surrounding the site. The classification of the aquifer beneath the site is a Class II aquifer, that is, currently being used, or a potential source of drinking water.

Groundwater Quality. Groundwater quality of the near-surface aquifer at the site ranges from good to fair. The range of hydraulic characteristics of the groundwater that might be encountered at the partially completed reactor site is presented in Table 3.10.4-2.

Groundwater Availability, Use, and Rights. Groundwater rights concerning the aquifer(s) near the partially completed reactor site would be associated with the reasonable use doctrine. Under this doctrine, landowners can withdraw groundwater to the extent that they must exercise their rights in accordance with the similar rights of others.

3.13.5 GEOLOGY AND SOILS

Geology. The partially completed reactor site is defined as being located in a flat valley surrounded by an area consisting of alternating valleys and hills. This area could be underlain by rocks composed of dolomite, limestone, and shale of Paleozoic age (225 to 600 million years).

The partially completed reactor site is located in Seismic Zone 1, which suggests there could be minor levels of damage in the event of an earthquake (Figure 3.2.5–1). The nearest potential earthquake with an MMI of V could be located within approximately 8 km (5 mi) from the partially completed LWR site (Table 3.2.5–1). The nearest known epicenter of a damaging earthquake (MMI of VII or greater) could be approximately 80 km (50 mi) from the partially completed reactor site. The partially completed LWR facility is not located in a volcanically active region.

Soils. The partially completed reactor site is located where the predominant soil types range from loamy clays to loamy sands. These soils range from poorly to well drained soils. The erosion potential could range from minor to severe in those areas with slopes greater than 25 percent and that have been eroded in the past. The soil's shrink-swell potential could range from low to severe, which is acceptable for standard construction techniques, depending upon the engineering controls employed. Wind erosion potential could range from minor to severe.

3.13.6 BIOLOGICAL RESOURCES

The representative partially completed reactor site is located within the deciduous forest vegetation type. Biological resources found within this vegetation type are discussed in Section 3.10.6. At a given site, biological resources could vary from those typically associated with the principal vegetation type identified above due to a variety of factors, including previous disturbance by man.

3.13.7 CULTURAL AND PALEONTOLOGICAL RESOURCES

Prehistoric Resources. Prehistoric resources at the representative partially completed reactor site may include sites, districts, or isolated artifacts. Archaeological sites located at the generic site may represent occupation during the Archaic, Woodland, or Mississippian periods, and could include hunting and butchering sites and short occupation campsites, or long-term occupation sites with remains of structures, hearths, and storage pits. They may yield artifacts such as stone tools and associated manufacturing debris, and ceramic potsherds. Some sites may have been determined eligible for inclusion on the NRHP by the SHPO.

Historic Resources. Historic resources may include cemeteries, remains of residential or commercial structures, standing structures, or roads. Some sites may be eligible for inclusion on the NRHP, and some may be listed with the SHPO.

Native American Resources. Native American resources may exist at the site. These resources can include objects, areas, or natural resources that are important to Native American groups for religious or historical reasons. Such resources can include cemeteries, geological or geographical elements such as mountains or creeks, certain species of animals or plants, or trails. There could also be visual impacts to Native American resources.

Paleontological Resources. To date no paleontological resources have been identified for the partially completed reactor site. The site is located on limestone formations. These formations can be fossil-bearing, so some paleontological resources may exist within the site boundaries.

3.13.8 SOCIOECONOMICS

Operation of the representative partially completed reactor site could potentially affect the socioeconomic environment of a given REA or ROI. The characteristics of the REA, ROI, and community depend upon geographic location. For employment and income, the economic area would be based upon industry interaction and linkages in the region. The anticipated residential distribution of project-related employees and their families would determine the ROI. This ROI would contain all principal jurisdictions and school districts for community services likely to be affected by the proposed activity. Local transportation would be the existing principal road, air, and rail networks required to support the project activities.

The representative site is located in a small community approximately 104 km (64.6 mi) from an urbanized area. Statistics for employment and regional economy are presented for the REA that encompasses 12 counties around the representative site. Statistics for the remaining socioeconomic characteristics are presented for the ROI, a three-county area (Counties A, B, and C) surrounding the site.

Regional Economy Characteristics. Selected employment and regional economy statistics for the representative site's REA are given in Figure 3.13.8-1. Between 1980 and 1990, the civilian labor force in the REA increased 20.3 percent to the 1990 level of 430,100. The 1994 unemployment in the REA was 6.1 percent, which was approximately equal to unemployment for the representative State (6.0 percent). The per capita income in 1993 was \$17,796, which was similar to the State's per capita income of \$17,129.

As shown in Figure 3.13.8-1, farming represented 4 percent and governmental activities 18 percent of the total employment within the site's REA. This compares with the State rates of 3 and 18 percent for farming and government employment, respectively. Nonfarm private sector activities of manufacturing, retail trade, and services were 24, 16, and 21 percent, respectively, of the total regional employment for the representative site's REA. These were slightly different than the representative State's percentages for manufacturing (18 percent), retail trade (16 percent), and services (23 percent).

Population and Housing. Population in the ROI increased 20.9 percent from 1980 to 1994, compared to 8.3 percent in the representative State. The number of housing units increased 25.9 percent between 1980 and 1990, which was approximately 10 percent greater than the increase in the number of housing units for the entire State. The 1990 ROI homeowner vacancy rate, 1.9 percent, and the rental vacancy rate, 9.2 percent, were similar to those experienced in the representative State. Population and housing trends are summarized in Figure 3.13.8-2.

Community Services. Education, public safety, and health care characteristics were used to assess the level of community service in the representative ROI. These characteristics are summarized in Figures 3.13.8-3 and 3.13.8-4.

Education. In 1994, six school districts provided public education services and facilities in the representative ROI. As seen in Figure 3.13.8-3, these school districts operated between 69.7-percent and 100-percent capacity. The average student-to-teacher ratio for the ROI was 15.5:1.

Public Safety. City, county, and State law enforcement agencies provided police protection to the residents in the ROI. In 1994, a total of 546 sworn police officers were serving the three-county ROI. The average officer-to-population ratio in the ROI was 1.5 officers per 1,000 persons. Figure 3.13.8-4 compares police force strengths across the ROI.

Fire protection services in the representative ROI were provided by 1,490 paid and volunteer firefighters in 1995. The average firefighter-to-population ratio in the ROI was 4.1 firefighters per 1,000 persons, as indicated in Figure 3.13.8-4.

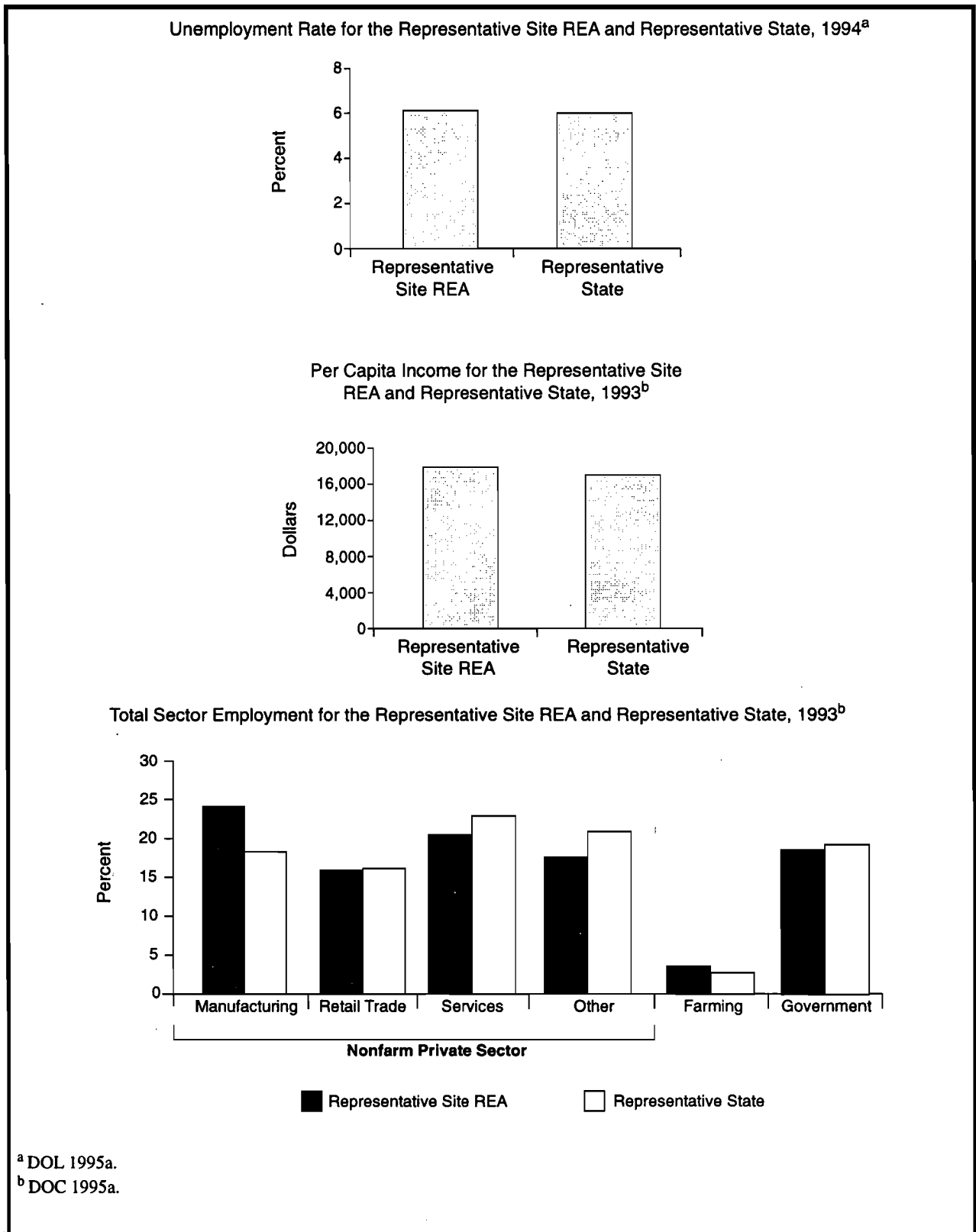


Figure 3.13.8-1. Employment and Local Economy for the Representative Partially Completed Reactor Site Regional Economic Area and the Representative State.

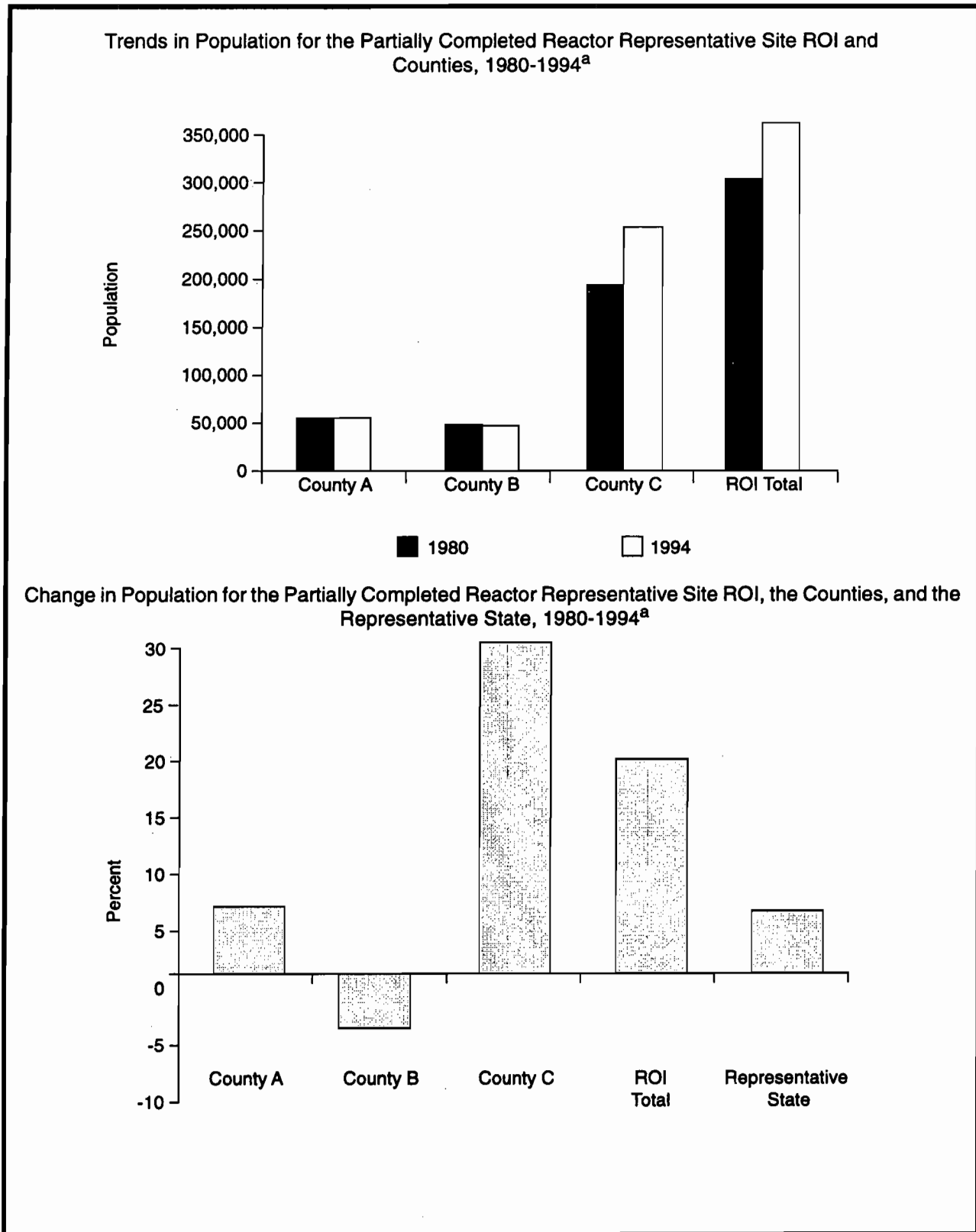


Figure 3.13.8-2. Population and Housing for the Representative Partially Completed Reactor Site Region of Influence and the Representative State.

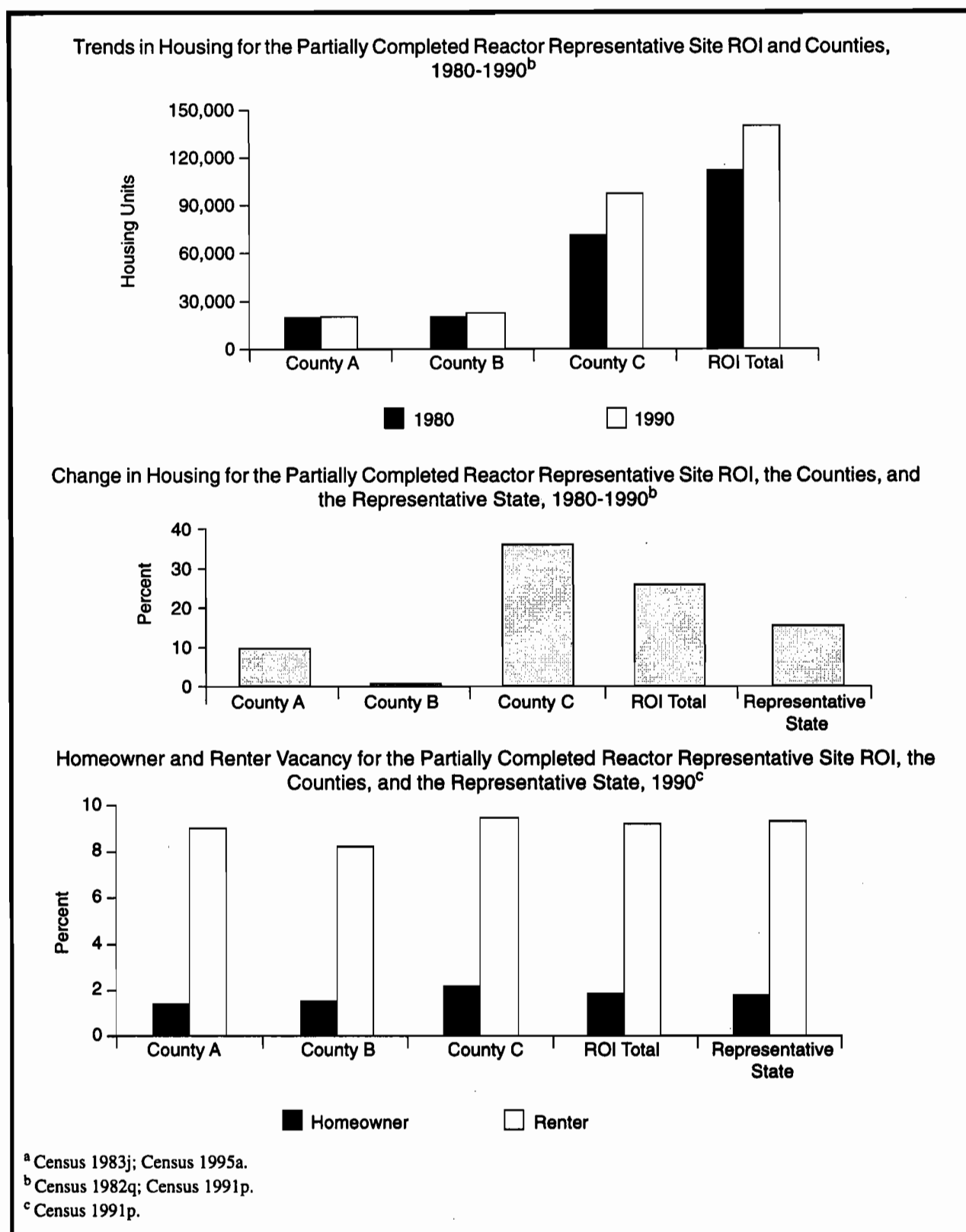


Figure 3.13.8-2. Population and Housing for the Representative Partially Completed Reactor Site Region of Influence and the Representative State—Continued.

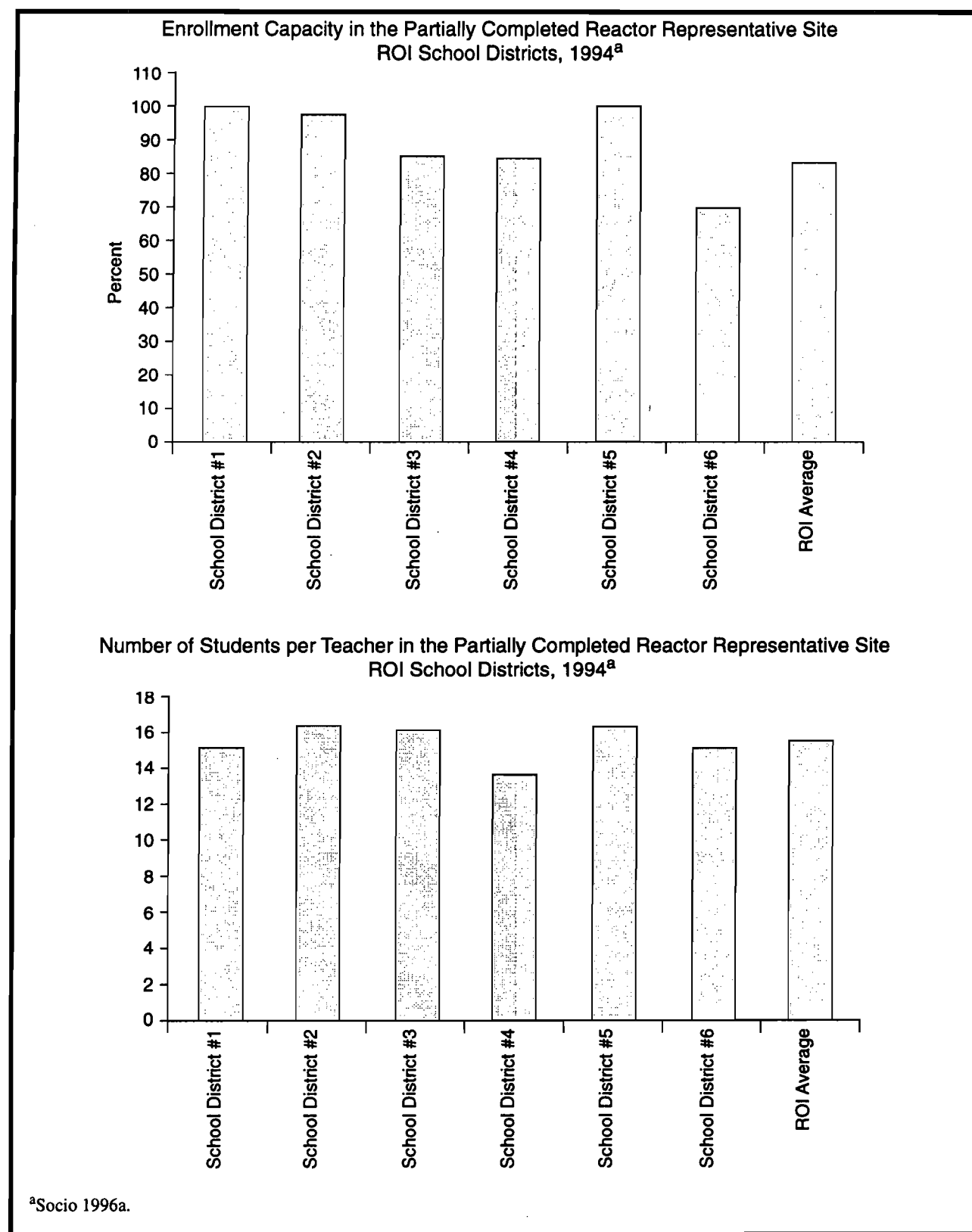


Figure 3.13.8-3. School District Characteristics for the Representative Partially Completed Reactor Site Region of Influence.

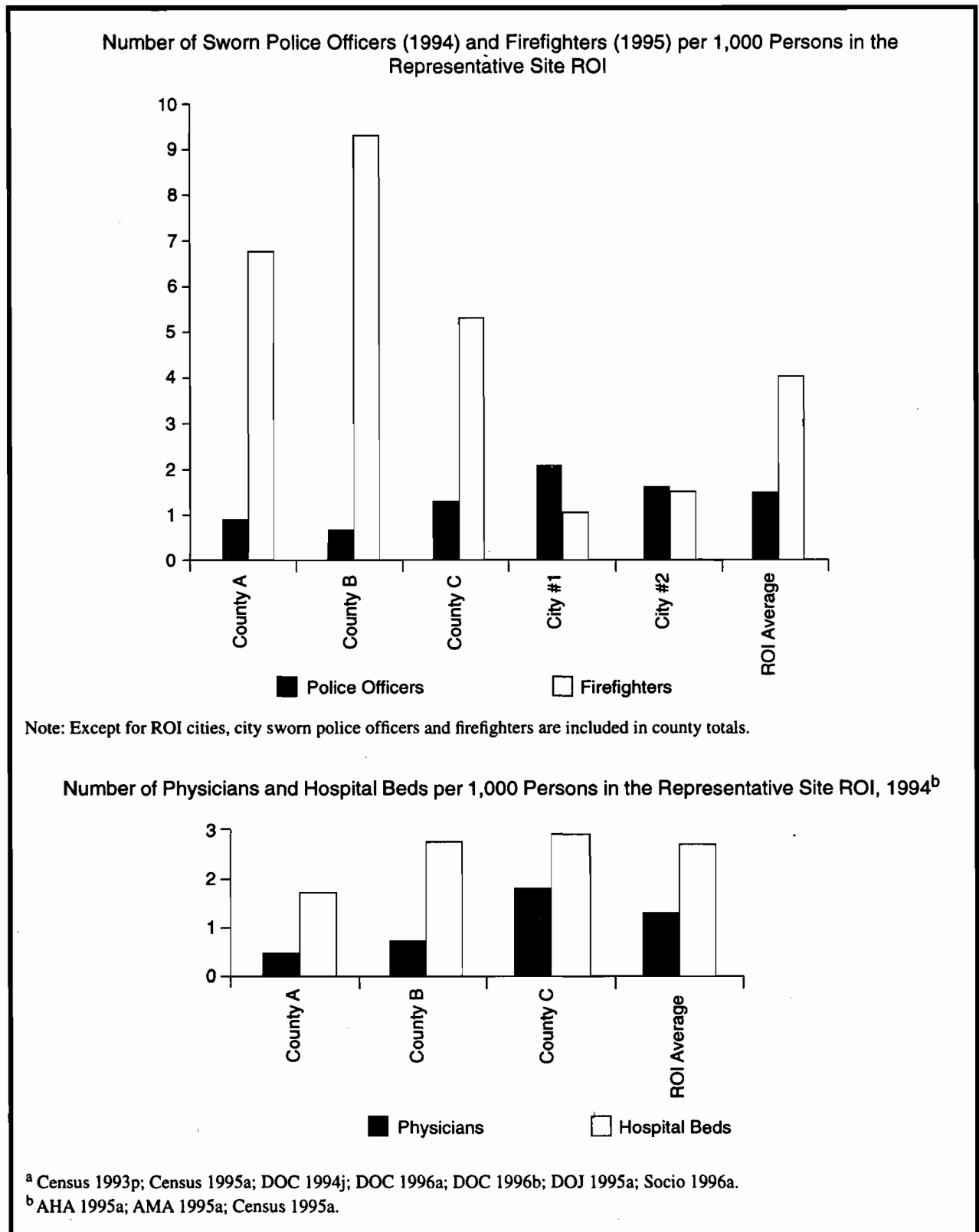


Figure 3.13.8-4. Public Safety and Health Care Characteristics for the Representative Partially Completed Reactor Site Region of Influence.

Health Care. Seven hospitals served the three-county ROI, with all operating below capacity. Figure 3.13.8-4 displays the hospital bed-to-population ratios for the ROI counties. The average ROI hospital occupancy rate was 58.9 percent in 1994, and a total of 525 physicians served the ROI. The average physician-to-population ratio for the ROI was 1.4 per 1,000 persons.

Local Transportation. Local transportation consists of the existing principal road, air, and rail networks required to support the project activities. Transportation networks in the smaller communities would generally be limited. However, due to its proximity to an urbanized area, the transportation networks at the representative site would be more extensive than in a more secluded community.

3.13.9 PUBLIC AND OCCUPATIONAL HEALTH AND SAFETY

Radiation Environment. Major sources and levels of background radiation exposure to individuals in the vicinity of the representative partially completed reactor site (and to any onsite workers) are shown on Table 3.13.9-1. Annual background radiation doses to individuals are expected to remain constant over time. The total dose to the population changes as the population size changes.

Table 3.13.9-1. Sources of Radiation Exposure to Individuals in the Vicinity, Unrelated to Operation at the Partially Completed Reactor Site

Source	Effective Dose Equivalent (mrem/yr)
Natural Background Radiation	
Cosmic radiation ^a	28
External terrestrial radiation ^a	29
Internal terrestrial radiation ^b	39
Radon in homes (inhaled) ^b	200
Other Background Radiation^b	
Diagnostic x rays and nuclear medicine	53
Weapons test fallout	<1
Air travel	1
Consumer and industrial products	10
Total	361

^a Derived from information given in EPA 1981b.

^b NCRP 1987a.

Note: Value for radon is an average for the United States.

Releases of radionuclides to the environment from an operational nuclear reactor site would provide another source of radiation exposure to members of the public. However, because the partially completed reactor has never operated, releases of radionuclides from it, and the resulting doses and health effects, are taken to equal zero for the existing conditions.

Similarly, the nonoperational status of the reactor precludes exposure of workers to radioactivity. The associated doses and health effects to workers are also taken to equal zero for the existing conditions.

Chemical Environment. The background chemical environment important to human health consists of the atmosphere, which may contain hazardous chemicals that can be inhaled; drinking water, which may contain hazardous chemicals that can be ingested; and other environmental media with which people may come in contact (for example, surface waters during swimming and soil through direct contact or via the food pathway). The baseline data for assessing potential health impacts from the chemical environment are those presented in Section 3.13.3.

Health Effects Studies. Specific locations for the partially completed reactor must be designated before any reviews of epidemiologic studies in the areas can be conducted.

Accident History. Since the reactor has never operated at the site, there is no site accident history.

Emergency Preparedness. Sites that are licensed by the NRC must have an emergency management program that would be activated in the event of an accident. The program must be compatible with all other Federal, State, and local plans and be thoroughly coordinated with all interested groups. The program would have to be developed and approved before operation of the completed reactor.

3.13.10 WASTE MANAGEMENT

This section addresses the management of wastes associated with a representative partially completed reactor site. Because construction of the reactors at the site has been deferred, the only activities currently at the site are maintenance and limited engineering design work.

Spent Nuclear Fuel. No spent nuclear fuel is currently generated by this facility.

High-Level Waste. No HLW is currently generated by this facility.

Transuranic Waste. No TRU waste is currently generated by this facility.

Low-Level Waste. No LLW is currently generated by this facility.

Mixed Low-Level Waste. No mixed LLW is currently generated by this facility.

Hazardous Waste. The representative partially completed reactor is considered a small quantity hazardous waste generator (less than 100 kg/month [220 lb/month]) as defined in 40 CFR 261.5. Hazardous wastes currently generated from maintenance activities include Pb, spent solvents, and used oils. Approximately 454 kg (1,000 lbs) per year is currently generated. Hazardous wastes are packaged and shipped offsite to the TVA hazardous waste storage facility at Muscle Shoals, Alabama. Once sufficient quantities have accumulated, the hazardous wastes are shipped to commercial RCRA-permitted treatment and disposal facilities.

Nonhazardous Waste. Liquid sanitary wastewater from the representative partially completed reactor site is sent to the Hollywood sewer system and eventually treated at the Hollywood Sanitary Treatment Plant. Solid nonhazardous wastes such as desiccants and normal housekeeping trash is collected in dumpsters and transported offsite to a permitted landfill by a commercial contractor. Large desiccants are packaged in drums and transported to a permitted landfill by the commercial contractor.



*Office of
Fissile Materials Disposition*

United States Department of Energy

***Storage and Disposition of
Weapons-Usable Fissile Materials
Final Programmatic Environmental
Impact Statement***

Volume II - Part A

December 1996

**For Further Information Contact:
U.S. Department of Energy
Office of Fissile Materials Disposition, 1000 Independence Ave., SW, Washington, DC 20585**

COVER SHEET

RESPONSIBLE AGENCY: U.S. Department of Energy (DOE)

TITLE: *Storage and Disposition of Weapons-Usable Fissile Materials Final Programmatic Environmental Impact Statement (DOE/EIS-0229)*

CONTACTS:

For further information on this programmatic environmental impact statement (PEIS), call (202) 586-4513 or fax (202) 586-4078 or contact:

Mr. J. David Nulton

Director

Office of NEPA Compliance and Outreach

Office of Fissile Materials Disposition

U.S. Department of Energy

1000 Independence Ave., SW

Washington, DC 20585

(202) 586-4513

For further information on the U.S. Department of Energy/*National Environmental Policy Act* (NEPA) process, call (800) 472-2756

or contact:

Ms. Carol Borgstrom

Director

Office of NEPA Policy and Assistance (EH-42)

Office of Environment, Safety and Health

U.S. Department of Energy

1000 Independence Ave., SW

Washington, DC 20585

(202) 586-4600

ABSTRACT: This document analyzes the potential environmental consequences of alternatives for the long-term storage (up to 50 years), including storage until disposition, and disposition of weapons-usable fissile materials from U.S. nuclear weapon dismantlements under the responsibility of the DOE. Long-term storage of nonsurplus inventories of weapons-usable plutonium (Pu) and highly enriched uranium (HEU) are required for national defense purposes, while the disposition of surplus weapons-usable Pu is necessary in order to implement our national nonproliferation policy. In addition to the No Action Alternative, this PEIS assesses three storage alternatives (that is, upgrade at multiple sites, consolidation of Pu, and collocation of Pu and HEU) at six DOE candidate sites located across the country. These sites are Hanford Site, Nevada Test Site, Idaho National Engineering Laboratory, Pantex Plant, Oak Ridge Reservation, and Savannah River Site. Although they are not candidate sites for storage, Rocky Flats Environmental Technology Site (RFETS) and Los Alamos National Laboratory are assessed for the No Action Alternative. For the disposition of surplus Pu, three alternative categories (that is, deep borehole, immobilization, and reactor) with nine primary alternatives are assessed at several DOE and representative sites for analysis purposes. Evaluations of impacts on site infrastructure, water resources, air quality and noise, socioeconomics, waste management, public and occupational health and safety, and environmental justice are included in the assessment. The intersite transportation of nuclear and hazardous materials is also assessed. DOE's Preferred Alternative is identified in this Final PEIS. The Preferred Alternative for storage is a combination of No Action and Upgrade Alternatives for the various DOE sites, and phaseout of Pu storage at RFETS. The Preferred Alternative for disposition of surplus Pu is to pursue a disposition strategy involving a combination of immobilization and reactor alternatives, including vitrification, ceramic immobilization, and existing reactors.

PUBLIC INVOLVEMENT: The DOE issued a Draft PEIS on March 8, 1996, and held a formal public comment period on the Draft through June 7, 1996. In preparing the Final PEIS, DOE considered comments received via mail, fax, electronic bulletin board (Internet), and transcripts of messages recorded by telephone. In addition, comments and concerns were recorded by notetakers during interactive public meetings held during March and April 1996 in Denver, CO, Las Vegas, NV, Oak Ridge, TN, Richland, WA, Idaho Falls, ID, Washington, DC, Amarillo, TX, and North Augusta, SC. Comments received and DOE's responses to those comments are found in Volume IV of the Final PEIS.

FOREWORD

This is the *Storage and Disposition of Weapons-Usable Fissile Materials Final Programmatic Environmental Impact Statement* (PEIS), prepared by the U.S. Department of Energy, Office of Fissile Materials Disposition. The document is composed of four volumes and a separate Summary. Changes made since the Draft PEIS are shown by change bar notation (vertical lines adjacent to the changes) in this Final PEIS for both text and tables. Deletion of one or more sentences is indicated by the phrase "Text deleted." in brackets. This Final PEIS includes the Preferred Alternative, which is a combination of alternatives. The Preferred Alternative is described in Section 1.6 and Chapter 2 of Volume I, and analyzed in Chapter 4 of Volume II. For all the alternatives, including the Preferred Alternative, a comparison of alternatives is presented in Section 2.5 of Volume I and a summary of impacts is presented in Section 4.6 of Volume II (Part B). Information from these sections is also presented in the Summary.

Volume I contains Chapters 1 through 3 of the PEIS. Chapter 1 includes a description of the history and background of the fissile materials disposition program, the purpose of and need for the proposed action, a summary of changes made to the Draft PEIS, and the Preferred Alternative. Chapter 2 gives a description of the proposed long-term storage and disposition alternatives, a description of how the alternatives were selected and why others were eliminated from further consideration, and a comparison of the alternatives in terms of their potential environmental impacts. Chapter 3 describes the affected environment at candidate long-term storage locations, and at sites and environmental settings for the disposition alternatives.

Volume II (Parts A and B) contains Chapters 4 through 10 of the PEIS. Chapter 4 describes the potential environmental impacts resulting from construction and operation of the proposed long-term storage and disposition alternatives, including the Preferred Alternative. Also contained in this chapter are intersite transportation impacts, a discussion of environmental justice issues, cumulative impacts due to the implementation of the proposed alternatives in addition to other actions at a site, avoided environmental impacts, and a summary of impacts. Chapter 5 provides a list of references used in the preparation of this document. Chapter 6 provides an index to the main text of the PEIS. Chapter 7 is a glossary of key terms used in the document. Chapter 8 is a list of preparers. Chapter 9 lists government agencies and organizations contacted during the preparation of this PEIS. Chapter 10 provides a distribution list for the document.

Volume III contains the appendices to this PEIS. Appendix A contains the fact sheet on the President's *Nonproliferation and Export Control Policy*, and the Joint Statement Between the United States and Russia on Nonproliferation. Appendix B provides specifications for key buildings within each facility complex analyzed in this PEIS. Appendix C describes requirements for construction and operation of the various facilities required to accomplish the storage and disposition activities essential to the alternatives described in this PEIS. Appendix D provides information on overall water usage for the storage and disposition facilities discussed in this PEIS. Appendix E gives a general overview of the Department of Energy (DOE) environmental restoration and waste management program, baseline waste management at DOE sites, and project-specific waste management activities associated with the proposed long-term storage and disposition alternatives. Appendix F provides detailed data supporting the air quality and noise analyses. Appendix G describes the methodology used for intersite transportation risk analysis and provides a summary of hazardous materials shipped to and from DOE sites, plus information on shipping containers. Appendix H evaluates various plutonium waste forms for potential disposal in a high-level waste repository. Appendix I describes operations of a Canadian Deuterium Uranium Reactor. Appendix J identifies the compliance requirements associated with the Proposed Action, as specified by the major Federal and State environmental, safety, and health statutes, regulations, and orders. Appendix K lists the scientific names of common nonthreatened and nonendangered animal and plant species identified in Chapters 3 and 4. Appendix L includes the supporting data used for assessing the No Action

Alternative in the socioeconomics sections of this PEIS. Appendix M presents detailed information on the potential health risks associated with releases of radioactivity and hazardous chemicals from the proposed storage and disposition alternatives during normal operations and from postulated accidents. Appendix N describes different concepts for, and provides cost and benefit information on, the multipurpose reactor. Appendix O provides a description of facilities and operations for a can-in-canister approach to plutonium immobilization at the Savannah River Site in South Carolina. Appendix P describes the potential environmental impacts of using the Manzano Weapons Storage Area in New Mexico for the long-term storage of plutonium pits. Appendix Q identifies the potential health impacts from the storage of Rocky Flats Environmental Technology Site plutonium pits at the Pantex Plant in Texas. Appendix R discusses the aircraft crash and radioactive release probabilities for proposed storage and disposition facilities at Pantex Plant in Texas. A separate Classified Appendix was also prepared, which provides detailed analysis results for intersite transportation risks based on classified inventories of materials stored at DOE sites.

Volume IV (Parts A and B) is the Comment Response Document. It contains an overview of the public comment process, the comments received on the Draft PEIS during the public review period, and the DOE responses to those comments, including identifying changes made to the Draft PEIS in response to public comments.

The Summary provides a brief overview of the PEIS. It includes the purpose of and need for the Proposed Action, a description of the storage and disposition alternatives including the Preferred Alternative, and the potential environmental impacts resulting from these alternatives.

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LIST OF ACRONYMS AND ABBREVIATIONS

AADT	Average Annual Daily Traffic
ACEC	Area of Critical Environmental Concern
ACGIH	American Conference of Governmental Industrial Hygienists
AEA	<i>Atomic Energy Act</i>
AEC	Atomic Energy Commission
AGV	automated guided vehicle
ALARA	as low as reasonably achievable
ALE	Arid Lands Ecology Reserve
ANL-W	Argonne National Laboratory-West
APSF	Actinide Packaging and Storage Facility
AQCR	Air Quality Control Region
ARA	Auxiliary Reactor Area
ARIES	Advanced Recovery and Integrated Extraction System
BEA	Bureau of Economic Analysis
BEIR	biological effects of ionizing radiation
BLM	Bureau of Land Management
BOP	balance-of-plant
BPA	Bonneville Power Administration
BWR	boiling water reactor
CAA	<i>Clean Air Act</i>
CANDU	Canadian deuterium uranium
CAS	Chemical Abstracts Service
CCDF	complimentary cumulative distribution function
CEQ	Council on Environmental Quality
CERCLA	<i>Comprehensive Environmental Response, Compensation, and Liability Act</i>
CFA	Central Facilities Area
CFR	Code of Federal Regulations
CGTO	Consolidated Group of Tribes and Organizations
CI	confidence interval
CIC	can-in-canister
CLUP	Comprehensive Land-Use Plan
CMR	Chemistry and Metallurgy Research

COE	Corps of Engineers
Complex	Nuclear Weapons Complex
CRD	Comment Response Document
CRT	Cargo Restraint Transporters
CWA	<i>Clean Water Act</i>
D&D	decontamination and decommissioning
DAF	Device Assembly Facility
DCG	derived concentration guide
DHLW	defense high-level waste
DNB	departure of nucleate boiling
DNFSB	Defense Nuclear Facilities Safety Board
DNL	day and night average sound levels
DNWR	Desert National Wildlife Range
DoD	Department of Defense
DOE	Department of Energy
DOT	Department of Transportation
DP	Office of Defense Programs
DRCOG	Denver Regional Council of Governments
DWPF	Defense Waste Processing Facility
EA	environmental assessment
EBR	Experimental Breeder Reactor
EDNA	Environmental Design for Noise Abatement
EIA	Energy Information Administration
EIS	environmental impact statement
EM	Office of Environmental Management
EPA	Environmental Protection Agency
ERR	excess relative risk
ES&H	Office of Environment, Safety, and Health
ESA	<i>Endangered Species Act</i>
ETF	effluent treatment facility
FAIR	Forest, Agriculture, Industry, and Research
FCF	Fuel Cycle Facility
FEMA	Federal Emergency Management Agency
FFCA	Federal Facility Compliance Agreement
FFTF	Fast Flux Test Facility

FLPMA	<i>Federal Land Planning Management Act</i>
FMEF	Fuels and Materials Examination Facility
FMF	Fuel Manufacturing Facility
FONSI	Finding of No Significant Impact
FR	Federal Register
FSAR	Final Safety Analysis Report
GBZ	Glass-bonded zeolite
GESMO	Generic Environmental Statement on Mixed Oxide
GIS	Geographical Information System
GMA	<i>Growth Management Act</i>
GMODS	Glass Material Oxidation Dissolution System
HAD	hazard analysis document
Hanford	Hanford Site
HE	high explosives
HEAST	Health Effects Summary Table
HEPA	high-efficiency particulate air
HEU	highly enriched uranium
HEU EIS	<i>Disposition of Surplus Highly Enriched Uranium Environmental Impact Statement</i>
HFEF	Hot Fuel Examination Facility
HI	Hazard Index
HLW	high-level waste
HQ	Hazard Quotient
HRA EIS	<i>Hanford Remedial Action Environmental Impact Statement and Comprehensive Land Use Plan</i>
HVAC	Heating Ventilation and Air Conditioning
HWR	Heavy Water Reactor
IAEA	International Atomic Energy Agency
ICPP	Idaho Chemical Processing Plant
ICRP	International Commission of Radiological Protection
INEL	Idaho National Engineering Laboratory
IRIS	Integrated Risk Information System
ISCST2	Industrial Source Complex Short-Term Model Version 2
ISO	International Standards Organization
IWG	Interagency Working Group
K-25	K-25 Site

L/ER	Energy Research Program Office
LA	Limited Area
LAA	Limited Access Area
LANL	Los Alamos National Laboratory
LANSCE	Los Alamos Neutron Scattering Center
LCF	latent cancer fatalities
LDR	Land Disposal Restriction
LEU	low-enriched uranium
LIGO	Laser Interferometer Gravitational-Wave Observatory
LLNL	Lawrence Livermore National Laboratory
LLW	low-level waste
LOB	Laboratory Office Building
LWR	Light Water Reactor
MAA	Material Access Area
MACCS	Melcor Accident Consequence Code System
MC&A	Material Control and Accountability
MD	Office of Fissile Materials Disposition
MEI	maximally exposed individual
MHR	Modular Helium Reactor
MMI	Modified Mercalli Index
MOX	mixed oxide
MSL	mean sea level
NAAQS	National Ambient Air Quality Standards
NAGPRA	<i>Native American Graves Protection and Repatriation Act</i>
NAS	National Academy of Sciences
NCDC	National Climatic Data Center
NCRP	National Commission of Radiological Protection
NEIC	National Earthquake Information Center
NEPA	<i>National Environmental Policy Act</i>
NERP	National Environmental Research Park
NESHAP	National Emission Standards for Hazardous Air Pollutants
NFS	Nuclear Fuel Services Fuel Fabrication Plant
NHPA	<i>National Historic Preservation Act</i>
NIOSH	National Institute of Occupational Safety and Health
NMSF	Nuclear Material Storage Facility

NMSM	Nuclear Materials and Stockpile Management
NOAA	National Oceanic and Atmospheric Administration
NOI	Notice of Intent
NPDES	National Pollutant Discharge Elimination System
NPL	National Priorities List
NRC	Nuclear Regulatory Commission
NRF	Naval Reactors Facility
NRHP	National Register of Historic Places
NTS	Nevada Test Site
NTS EIS	<i>Environmental Impact Statement for the Nevada Test Site and Off-Site Locations in the State of Nevada</i>
NWI	National Wetlands Inventory
NWPA	<i>Nuclear Waste Policy Act</i>
NWS	National Weather Service
OCRWM	Office of Civilian Radioactive Waste Management
ORISE	Oak Ridge Institute for Science and Education
ORNL	Oak Ridge National Laboratory
ORR	Oak Ridge Reservation
OSHA	Occupational Safety and Health Administration
PA	Protected Area
Pantex	Pantex Plant
Pantex EIS	<i>Environmental Impact Statement for the Continued Operation of the Pantex Plant and Associated Storage of Nuclear Weapon Components</i>
PBF	Power Burst Facility
PCV	Primary Containment Vessel
PEIS	programmatic environmental impact statement
PEL	Permissible Exposure Level
PFP	Plutonium Finishing Plant
PFP EIS	<i>Plutonium Finishing Plant Stabilization Environmental Impact Statement</i>
PIDAS	Perimeter Intrusion Detection and Alarm System
PNNL	Pacific Northwest National Laboratory
PPA	Property Protection Area
PRA	probabilistic risk assessment
PSAR	Preliminary Safety Analysis Report
PSD	Prevention of Significant Deterioration

PUREX	Plutonium-Uranium Extraction Plant
PWR	pressurized water reactor
R&D	Research and Development
RCRA	<i>Resource Conservation and Recovery Act</i>
REA	regional economic area
RIA	reactivity insertion accident
RFETS	Rocky Flats Environmental Technology Site
RIMS II	Regional Input-Output Modeling System
RL	Richland Operations Office
ROD	Record of Decision
ROI	region of influence
RSWF	Radioactive Scrap and Waste Facility
RWMC	Radioactive Waste Management Complex
RWMS	Radioactive Waste Management Site
SAR	Safety Analysis Report
SARA	<i>Superfund Amendments and Reauthorization Act</i>
sd	standard deviation
SDWA	<i>Safe Drinking Water Act</i>
SEB	Security Equipment Building
SHPO	State Historic Preservation Officer
SIP	State Implementation Plan
SISMP	Site Integrated Stabilization and Management Plan
SMR	Standardized Mortality Ratio
SNF	spent nuclear fuel
SNL	Sandia National Laboratories
SRR	standardize rate ratio
SRS	Savannah River Site
Stockpile Stewardship and Management PEIS	<i>Programmatic Environmental Impact Statement for Stockpile Stewardship and Management</i>
Storage and Disposition PEIS	<i>Storage and Disposition of Weapons-Usable Fissile Materials Programmatic Environmental Impact Statement</i>
SST	safe secure trailer
START	Strategic Arms Reduction Talks

TA	Technical Area
TAN	Test Area North
TCLP	toxicity characteristic leaching procedure
TDEC	Tennessee Department of Environmental Conservation
TDS	total dissolved solids
TI	transport index
TLV	Threshold Limit Values
TNRCC	Texas Natural Resources Conservation Commission
TRA	Test Reactor Area
TRU	transuranic
TSCA	<i>Toxic Substance Control Act</i>
TSD	Transportation Safeguards Division
TSP	total suspended particulates
TSR PEIS	<i>Tritium Supply and Recycling Programmatic Environmental Impact Statement</i>
TVA	Tennessee Valley Authority
USFWS	United States Fish and Wildlife Services
USGS	United States Geological Survey
VOC	volatile organic compound
VRM	Visual Resource Management
WAC	Waste Acceptance Criteria
Waste Management PEIS	<i>Waste Management Programmatic Environmental Impact Statement for Managing Treatment, Storage, and Disposal of Radioactive and Hazardous Waste</i>
WIPP	Waste Isolation Pilot Plant
WMIS	Waste Management Information System
WNP	Washington Nuclear Power
WPPSS	Washington Public Power Supply System
WSA	Weapons Storage Area
WSCC	Western Systems Coordinating Council
WSCF	Waste Sampling and Characterization Facility
Y-12	Y-12 Plant
Y-12 EA	<i>Environmental Assessment for the Proposed Interim Storage of Enriched Uranium Above the Maximum Historical Level at the Y-12 Plant, Oak Ridge, Tennessee</i>
YMSCO	Yucca Mountain Site Characterization Office
ZPPR	Zero Power Physics Reactor

CHEMICALS AND UNITS OF MEASURE

°C	degrees Celsius
Ci	curie
cm	centimeter
CO	carbon monoxide
CO ₂	carbon dioxide
Co-60	cobalt-60
Cs	cesium
Cs-137	cesium-137
CsCl	cesium chloride
Cu	copper
dB	decibel
dBA	decibel A-weighted
°F	degrees Fahrenheit
ft	feet
ft ²	square feet
ft ³	cubic feet
g	gram
G	gravitational acceleration
gal	gallon
Gd	gadolinium
GWd	gigawatt-days
ha	hectare
H ₂	hydrogen
HF	hydrogen fluoride
HNO ₃	nitric acid
hr	hour
I-129	iodine-129
in	inch
k _{eff}	effective neutron multiplication factor
kg	kilogram
km	kilometer
km ²	square kilometer

Kr	krypton
kV	kilovolt
l	liter
lb	pound
m	meter
m ²	square meter
m ³	cubic meter
mCi	millicurie
mg	milligram
mi	mile
mi ²	square miles
min	minute
mph	miles per hour
mrem	millirem (one thousandth of a rem)
MW	megawatt
MWe	megawatt electric
N ₂	nitrogen
nCi	nanocurie (one-billionth of a Curie)
Ni	nickel
NO ₂	nitrogen dioxide
NO _x	nitrogen oxides
O ₃	ozone
oz	ounce
Pb	lead
PCB	polychlorinated biphenyl
pCi	picocurie (one-trillionth of a Curie)
PM ₁₀	particulate matter less than or equal to 10 microns
ppm	parts per million
Pu	plutonium
PuCl	plutonium chloride
PuO ₂	plutonium dioxide
rad	radiation absorbed dose
rem	roentgen equivalent man
RfC	Reference Concentration
RfD	Reference Dose

s	second
SO ₂	sulfur dioxide
Sr-90	strontium-90
t	metric ton
Tc-99	technetium-99
ton	short ton
U	uranium
U-233	uranium-233
U-234	uranium-234
U-235	uranium-235
U-236	uranium-236
U-238	uranium-238
UF ₆	uranium hexafluoride
UNH	uranyl nitrate hexahydrate
UO ₂	uranium dioxide
U ₃ O ₈	triuranium octaoxide
VOC	volatile organic compound
yd	yard
yr	year
μg	microgram (one-millionth of a gram)

METRIC CONVERSION CHART

To Convert Into Metric			To Convert Out of Metric		
If You Know	Multiply By	To Get	If You Know	Multiply By	To Get
Length					
inches	2.54	centimeters	centimeters	0.3937	inches
feet	30.48	centimeters	centimeters	0.0328	feet
feet	0.3048	meters	meters	3.281	feet
yards	0.9144	meters	meters	1.0936	yards
miles	1.60934	kilometers	kilometers	0.6214	miles
Area					
sq. inches	6.4516	sq. centimeters	sq. centimeters	0.155	sq. inches
sq. feet	0.092903	sq. meters	sq. meters	10.7639	sq. feet
sq. yards	0.8361	sq. meters	sq. meters	1.196	sq. yards
acres	0.40469	hectares	hectares	2.471	acres
sq. miles	2.58999	sq. kilometers	sq. kilometers	0.3861	sq. miles
Volume					
fluid ounces	29.574	milliliters	milliliters	0.0338	fluid ounces
gallons	3.7854	liters	liters	0.26417	gallons
cubic feet	0.028317	cubic meters	cubic meters	35.315	cubic feet
cubic yards	0.76455	cubic meters	cubic meters	1.308	cubic yards
Weight					
ounces	28.3495	grams	grams	0.03527	ounces
pounds	0.45360	kilograms	kilograms	2.2046	pounds
short tons	0.90718	metric tons	metric tons	1.1023	short tons
Temperature					
Fahrenheit	Subtract 32 then multiply by 5/9ths	Celsius	Celsius	Multiply by 9/5ths, then add 32	Fahrenheit

METRIC PREFIXES

Prefix	Symbol	Multiplication Factor
exa-	E	1 000 000 000 000 000 000 = 10^{18}
peta-	P	1 000 000 000 000 000 = 10^{15}
tera-	T	1 000 000 000 000 = 10^{12}
giga-	G	1 000 000 000 = 10^9
mega-	M	1 000 000 = 10^6
kilo-	k	1 000 = 10^3
hecto-	h	100 = 10^2
deka-	da	10 = 10^1
deci-	d	0.1 = 10^{-1}
centi-	c	0.01 = 10^{-2}
milli-	m	0.001 = 10^{-3}
micro-	μ	0.000 001 = 10^{-6}
nano-	n	0.000 000 001 = 10^{-9}
pico-	p	0.000 000 000 001 = 10^{-12}
femto-	f	0.000 000 000 000 001 = 10^{-15}
atto-	a	0.000 000 000 000 000 001 = 10^{-18}

Chapter 4

Environmental Consequences

The potential environmental consequences resulting from the proposed weapons-usable fissile materials storage alternatives, the Pu disposition alternatives, and the No Action Alternative are described in this chapter for each of the sites, environmental settings, and resource/issue areas described in Section 3.0. The impact methodology applied for each of these resource/issue areas is described in Section 4.1. In addition, descriptions of methodologies applied and the resulting environmental consequences for intersite transportation and environmental justice are found in Sections 4.4 and 4.5, respectively.

Section 4.2 describes the environmental consequences associated with the No Action Alternative and the long-term storage alternatives. Table 4-1 identifies the pages within the document where environmental consequences of the alternatives are analyzed for each of the sites. [Text deleted.] Environmental impacts of each long-term storage alternative and the No Action Alternative are analyzed for each of the six candidate storage sites to allow (1) the comparison of impacts by sites for each alternative and (2) the comparison of impacts by alternatives for each site. As a result, decisions can be made to select a single storage alternative for all sites, or a combination of different alternatives for different sites.

Table 4-1. Key to Locating Information on Environmental Consequences and Mitigation Measures for Storage Alternatives by Page Number^a

Alternatives	Sites							
	Hanford	NTS	INEL	Pantex	ORR	SRS	RFETS	LANL
No Action Alternative	4-23	4-83	4-131	4-182	4-240	4-291	4-343	4-363
Preferred Alternative	4-859	4-859	4-859	4-859	4-859	4-859	4-859	4-859
Upgrade at Multiple Sites Alternative	4-23	NA	4-131	4-182	4-240	4-291	NA	NA
Consolidation of Pu Alternative	4-23	4-83	4-131	4-182	NA ^b	4-291	NA	NA
Collocation of Pu and HEU Alternative	4-23	4-83	4-131	4-182	4-240	4-291	NA	NA

^a See also Sections 4.4 (Intersite Transportation) and 4.5 (Environmental Justice).

^b Consolidated Pu storage at ORR would create an HEU collocation condition and is analyzed as part of the Collocation Alternative.

Note: NA=alternative does not apply at the site.

For the Pu disposition alternatives analyzed in Section 4.3, specific site characteristics, as well as generic representative environmental settings, have been used in this PEIS for analyzing the potential environmental impacts of disposition technology alternatives. Six DOE sites and other generic and specific sites were used for assessing the environmental impacts of various disposition technologies and strategies. The locations of the new facilities considered for the various disposition technologies are representative and for analysis purposes only. Table 4-2 identifies the locations in this document where the disposition alternatives and common activities, and sites and environmental settings, have been analyzed. Since the disposition decision to be made encompasses the programmatic strategy and technology or technology mix that would be employed for disposition of the various forms of surplus weapons-usable Pu materials, generic cumulative environmental impact analysis of locating more than one disposition facility at a single site is described in Sections 4.6 and 4.7. Site-specific analysis would be made in follow-on tiered NEPA documentation.

Although analyzed individually, both pit disassembly/conversion and Pu conversion are front-end processes common to all of the disposition alternatives (except No Action). MOX fuel fabrication is a common activity to all of the reactor alternatives. In addition to a potential new MOX fuel fabrication facility that would be built in the United States, the Existing LWR Alternative initially could include MOX fuel fabrication abroad on an interim basis.

Table 4-2. Key to Locating Information on Environmental Consequences and Mitigation Measures for Disposition Alternatives by Page Number

Alternatives and Common Activities	Analysis Sites and Environmental Settings					
	Hanford	NTS	INEL	Pantex	ORR	SRS
Preferred Alternative	4-859	NA	4-859	4-859	NA	4-859
Common Activities						
Pit Disassembly/Conversion Facility	4-383	4-383	4-383	4-383	4-383	4-383
Pu Conversion Facility	4-427	4-427	4-427	4-427	4-427	4-427
Deep Borehole Category						
Direct Disposition Alternative	NA	NA	NA	NA	NA	NA
Immobilized Disposition Alternative						
Ceramic Immobilization Facility (for Borehole)	4-496	4-496	4-496	4-496	4-496	4-496
Deep Borehole Complex	NA	NA	NA	NA	NA	NA
Immobilization Category						
Vitrification Alternative	4-561	4-561	4-561	4-561	4-561	4-561
Ceramic Immobilization Alternative	4-605	4-605	4-605	4-605	4-605	4-605
Electrometallurgical Treatment Alternative ^a	NA	NA	4-657	NA	NA	NA
Reactor Category and Common Activities						
MOX Fuel Fabrication						
New Domestic Facility	4-673	4-673	4-673	4-673	4-673	4-673
Existing European Facility	NA	NA	NA	NA	NA	NA
Existing LWR Alternative	NA	NA	NA	NA	NA	NA
Partially Completed LWR Alternative	NA	NA	NA	NA	NA	NA
Evolutionary LWR Alternative	4-749	4-749	4-749	4-749	4-749	4-749
CANDU Reactor Alternative ^b	NA	NA	NA	NA	NA	NA

^a INEL is a representative site for the Electrometallurgical Treatment Alternative. If this alternative is selected, any of the six DOE sites could be used and subsequent NEPA documents would be prepared, as appropriate.

^b Activities in Canada are not fully analyzed in this PEIS but are discussed in Section 4.3.5.5 and Appendix I.

Note: NA=not applicable.

For the ocean transportation of fissile materials associated with the European MOX fuel fabrication option, the intersite transportation section (Section 4.4) analyzes potential impacts to the global commons, pursuant to Executive Order 12114, *Environmental Effects Abroad of Major Federal Actions*. Although actions proposed in other countries are not analyzed in this PEIS, changes in CANDU reactor operations due to the use of MOX fuel are described in Appendix I.

As noted in Section 2.4, the final disposal of immobilized forms and domestically produced spent fuel for some disposition alternatives would be accomplished by sending the materials to a geologic repository pursuant to NWA. ¹ Since a repository site has not yet been recommended by the President and approved by Congress, this PEIS does not analyze impacts to a repository. Such a geologic repository, if approved under the provisions of the NWA, would serve primarily as the disposal site for commercial and DOE-owned spent nuclear fuel and HLW. This impact analysis would be done in a separate EIS for the repository. Operation issues regarding the repository, however, are described in Appendix H.

A summary of the environmental consequences for all the proposed storage and disposition alternatives and the preferred alternative is presented in Section 4.6. Cumulative impacts associated with the alternatives are described in Section 4.7. Sections 4.8 through 4.11 provide descriptions of the following with regard to the alternatives: unavoidable adverse environmental impacts, avoided environmental impacts, relationship between short-term uses of the environment and the maintenance and enhancement of long-term productivity, and irreversible and irretrievable commitment of resources. Section 4.12 provides energy requirements and conservation potential of the various alternatives and mitigation measures.

4.1 METHODS FOR ASSESSING ENVIRONMENTAL IMPACTS

The environmental impact assessment methodologies discussed in this section address the full range of natural and human resource and issue areas pertinent to the sites considered for constructing and operating weapons-usable fissile materials storage and disposition alternatives. These resource/issue areas are land resources, site infrastructure, air quality and noise, water resources, geology and soils, biological resources, cultural and paleontological resources, socioeconomic, public and occupational health and safety, and waste management. A summary of major Federal and State environmental, safety, and health statutes, regulations, and orders applicable to the various resource/issue areas is provided in Appendix J.

As part of the impact assessment process, mitigation measures are identified that could be used to reduce and minimize potential impacts. Because these mitigation measures vary from site to site, some mitigation strategies may need to be addressed in subsequent site-specific environmental documents and/or through agency coordination, as required.

4.1.1 LAND RESOURCES

The land resources analysis assesses land use and visual resources for the defined ROI. The ROI for land use includes land within 3.2 km (2 mi) of a given candidate site; the ROI for visual resources includes those lands within the affected viewshed of the proposed action. Land resources impacts are analyzed within the context of NEPA and other related Federal legislation and executive orders. Land-use impacts associated with site-specific alternatives are compared to existing land-use patterns and densities, and to land-use plans, policies, and controls. Visual resource impacts are associated with changes in the existing landscape character that could result from the proposed action. Land resources impacts associated with alternatives for which site-specific locations have not been identified are assessed generically. For example, based on technology descriptions and site infrastructure requirements, likely land resources impacts are characterized for a range of land-use and

¹ Under the NWA, NRC may determine by rule that highly radioactive material requires permanent isolation as HLW in a geologic repository. Such a determination or legislative clarification may be required in order for the immobilized forms generated by the Immobilization Alternatives to be disposed of in a repository pursuant to NWA.

visual resources conditions that could support the specific technology. The No Action Alternative is based on the most current site development and facility utilization plans.

Land Use. The land-use analysis estimates the magnitude and extent of potential impacts to current land-use patterns and densities due to the implementation of the alternative under consideration. The impact analysis identifies the amount of land disturbed during construction and used during operation; the total amount of land required; and potential changes in land use and conflicts with land-use plans, policies, and controls. Potential impacts to special status lands, including prime farmland, are emphasized. Possible conflict with any related legislation or regulation is assessed since major regulatory conflicts could conceivably impede or prevent implementation. Conflicts with State and local land-use plans, policies, and controls could result in potential impacts. Conflicts with site development and facility utilization plans could result in potential impacts.

For storage alternatives, the Storage and Disposition PEIS identifies the land area required for operation as the area occupied by the footprint of each building and nonbuilding support areas. In conjunction with paved road, parking areas, graveled areas, and any land graded and cleared of vegetation, they constitute the total land area requirements. Of the land required during operation, the “disturbed area” is the land that was not in use and was previously undisturbed natural habitat. Previously disturbed areas, include graveled areas and any land previously graded and cleared of vegetation. All areas within the existing perimeter intrusion detection boundaries are classified as already disturbed areas. The construction laydown area accommodates material and equipment storage, and provides limited onsite fabrication areas and temporary construction buildings to support construction activities. The criteria for determining disturbed and undisturbed land area during construction is the same as for operation. Therefore, facilities or construction laydown areas proposed to be situated entirely on previously disturbed land area would not create any newly disturbed area.

Visual Resources. The visual resources analysis identifies and evaluates the magnitude and extent of potential changes to the visual environment that could result from implementation of the proposed alternative. Visual resources assessments are based on the BLM VRM methodology. The existing landscape at each analysis site was assigned a VRM classification as defined in Section 3.1.1, ranging from 1 (pristine areas including designated wilderness and wild and scenic rivers) to 5 (areas where the natural character of the landscape no longer exists). Important objectives of visual resources analysis are the identification of the degree of contrast between the proposed action and the existing landscape, the location and sensitivity levels of viewpoints accessible to the public, and the visibility of the proposed action from the viewpoints. Sensitivity levels of viewpoints are based on the number and concerns of the observers. The distance from a viewpoint to the affected area and atmospheric conditions are also taken into consideration because distance and haze can diminish the degree of contrast and visibility.

The Storage and Disposition PEIS does not include a complete and detailed VRM assessment for each disposition alternative because design plans are not available. An assessment of visual impacts is performed using the degree of visual contrast between the proposed facilities or activities and the existing landscape character as seen from viewpoints accessible to the public, such as public roadways, recreation areas, special status lands, and residential areas. Sensitivity levels of the viewpoints and visibility of the affected area from those viewpoints are also taken into consideration. The reduction of assigned VRM classification could result if the affected area could be seen from a viewpoint with a high sensitivity level.

4.1.2 SITE INFRASTRUCTURE

Site infrastructure impacts are assessed by overlaying the support requirements of the various alternatives on the projected site infrastructure capacities. These impact assessments focus on electrical power requirements, road networks, rail interfaces, and fuel requirements. Projection of electricity availability, site development plans, and other DOE mid- and long-range planning documents are utilized to describe existing site infrastructure conditions. Tables are presented depicting additional infrastructure requirements estimated for each alternative. Data for these comparison tables were obtained from detailed data input reports describing each potential facility that would be required under the various alternative actions. Design mitigation considerations that might reduce infrastructure demand are identified, where possible, on a site-by-site basis.

Under some Pu disposition alternatives, specific analysis sites are not identified. As a result, no planning documents are available to provide descriptions of the site infrastructure or to establish a detailed baseline from which environmental consequences can be estimated. For these cases, generic environmental baselines were developed to define conditions for analysis purposes. Site infrastructure impacts are assessed by analyzing the specific facilities and activities associated with the alternative that are necessary to locate new missions at the unspecified sites. As stated above, tables are presented to depict the additional infrastructure requirements for each alternative as a result of the new missions. Impact assessments focus on the additional electrical power, road networks, rail interfaces, and fuel required to perform the new missions located at the unspecified sites.

Detailed assessments of the availability of electric power for the various storage and disposition facilities' electrical power requirements in the year 2005 timeframe are not considered practical. Electric utilities would not be expected to reliably project how they would meet the needs of these facilities (that is, whether by new power generation, power imports, or demand-side management). Therefore, the basis for this PEIS assessment is the supply and demand projections of the U.S. electric utilities published annually by the North American Electric Reliability Council.

For purposes of analysis, electricity generation is based on the assumption that electricity would be supplied by the power pool currently supplying the facility in question by using a mix of fuels and generating sources representative of those projected. These data are used to determine whether there would be enough reserve margin within a particular power pool to accommodate electrical requirements or if additional power is required. A detailed analysis, based on the proportional contributions from each fuel source, would be conducted in site-specific NEPA documents, as appropriate.

Four of the Pu disposition alternative technologies, specifically the existing LWR, evolutionary LWR, partially completed LWR, and CANDU reactor, have the ability to produce electricity while using Pu as MOX fuel. The environmental effects of this steam production are included in the analysis of the basic technologies since design of these reactors includes steam turbines to generate electricity. Selection of either of two alternatives, the partially completed LWR or the evolutionary LWR, would result in additional power line construction to distribute electricity to the power grid. The environmental impacts of this additional power line construction for these two alternative actions are not addressed in this PEIS but would be assessed in tiered, site-specific NEPA documents should either be chosen for implementation.

4.1.3 AIR QUALITY AND NOISE

Air Quality. Potential effects on the environment associated with air pollutant emissions from normal operations for each alternative are evaluated, and effects of construction emissions are discussed. The assessment of air quality impacts requires identification of applicable criteria for assessing impacts, the development of emission inventories, and the estimation of air pollutant concentrations. The assessment of impacts is based on the estimated concentrations, data on the existing environment, and the assessment criteria. Human health effects due to air pollutant emissions are discussed in the Public and Occupational Health and Safety sections and include consideration of airborne radioactive chemical releases and from accidents initiated by natural phenomenon (for example, tornadoes).

The assessment of potential impacts to air quality is based upon comparison of effects of each alternative with applicable State, local, or NAAQS. Assessment criteria for air pollutants include the EPA primary and secondary ambient air quality standards for criteria pollutants, specified in 40 CFR 50, and ambient standards established by each State. The more stringent of either the EPA or State standards serve as the assessment criteria. The assessment criteria for hazardous or toxic pollutants include guidelines or standards adopted or proposed by each State. Hazardous and toxic air pollutants include those listed in Title III of the 1990 CAA Amendments, in the NESHAP, in 40 CFR 61, and in standards or guidelines proposed or adopted by the respective states.

Certain hazardous pollutants for specific industrial processes are regulated by NESHAPs. No sources to which NESHAPs apply have been identified for the alternatives being evaluated except for sources of beryllium which are discussed in the health effects sections. Some of the sites have existing NESHAPs sources for which emissions are quantified under the No Action alternative.

No Action concentrations of pollutants were determined by modeling site emissions. Site-specific emissions are modeled in accordance with the guidelines presented in the EPA's *Guidelines on Air Quality Models*. The EPA recommended Industrial Source Complex Short Term Model, Version 2 (ISCST2) was selected as the most appropriate model to perform the air dispersion modeling analysis because it is designed to support the EPA regulatory modeling program and is capable of handling multiple sources, including different source types. The air quality modeling analysis performed for the sites is a "screening level" analysis incorporating conservative assumptions applied to each of the sites so that the impacts associated with the respective alternatives could be compared among the sites. The "highest-high" concentration for each pollutant and averaging time is selected for comparison to the applicable assessment criteria, instead of the less conservative EPA-recommended "highest-high" and "highest second-highest" concentration for longer-term and short-term averaging times, respectively. The concentrations evaluated are the maximum occurring at or beyond the site boundary or public access road and include the contribution from the alternative and the baseline concentration. Concentrations presented for each alternative include the criteria pollutants CO, Pb, NO₂, PM₁₀, SO₂; pollutants for which there are State-mandated standards; and hazardous and other toxic pollutants that are emitted for the specific alternative. Appendix F contains additional information on the ISCST2 model.

Ozone is a secondary pollutant formed in the atmosphere and is not directly emitted as a pollutant from the candidate sites. The primary pollutants contributing to ozone formation are NO_x and VOCs. The formation of ozone in the atmosphere is a regional issue and is contributed to by vehicular sources (mobile sources), natural sources, and stationary sources in a region. Ozone, as a criteria pollutant, was not evaluated for this programmatic evaluation since it is not directly emitted or monitored by the candidate sites, but NO₂ and VOC emissions were analyzed where applicable.

Additional assumptions incorporated into the air quality modeling at each site include: major source criteria pollutant emissions were modeled using actual source locations and stack parameters to determine environmental baseline and No Action criteria pollutant concentrations; toxic/hazardous pollutant emissions

and sources with incomplete source characteristic information were modeled from a single source centrally located within the complex of facilities on each site assuming a 10-m (33-ft) stack height, a stack diameter of 0.3 m (1 ft), stack exit temperature equal to ambient temperature, and a stack exit velocity equal to 0.03 m/s (0.1 ft/s).

Input data for the model representing site emission rates were provided by the individual sites. Air emissions data for each alternative, other than No Action, are based on preconceptual design reports. Onsite or representative NWS meteorological data are used to define the dispersion characteristics of the site. Actual terrain heights are used for those sites not considered "flat."

The environmental consequences of construction activities on air quality are also described. Source control measures are described that are commonly used to control air pollutant emissions from construction activities. The concentrations presented in this document are the highest concentrations predicted by the model to present conservative estimates of pollutant concentrations.

The CAA, as amended in 1990 (U.S.C. 7506(c)), requires Federal actions to conform with the host State's "State Implementation Plan" (SIP). A SIP provides for the implementation, maintenance, and enforcement of NAAQS for the six criteria pollutants (that is, SO₂, PM₁₀, CO, O₃, NO₂ and Pb). The SIP's purpose is to eliminate or reduce the severity and number of violations of NAAQS and to expedite the attainment of these standards. No department, agency, or instrumentality of the Federal Government shall engage in, support in any way, or provide financial assistance for, license or permit, or approve any activity that does not conform to an applicable implementation plan.

The final rule for *Determining Conformity of General Federal Actions to State or Federal Implementation Plans* was established by EPA in November 30, 1993 (58 FR 63214), and took effect on January 31, 1994 (40 CFR Parts 6, 51, and 93). This rule establishes the conformity criteria and procedures necessary to meet the CAA until the required conformity SIP revision by each State is approved by EPA. Criteria for determining conformity are specified in some detail in the final rule, but basically ensure that emissions of all criteria air pollutants and VOCs from the action are specifically identified and accounted for in the SIP's attainment or maintenance demonstration.

The EPA has striven to ensure that the new conformity procedures are consistent with NEPA. This way, Federal agencies can incorporate the new conformity procedures into their existing NEPA procedures.

The EPA has limited the Conformity Rule to "nonattainment" areas or those areas classified after November 15, 1990, as "maintenance" areas. An area is designated as nonattainment for a criteria pollutant if it does not meet national primary or secondary ambient air quality standards for the pollutant (or if the area contributes to the ambient air quality of a nearby area that does not meet national primary or secondary ambient air quality standards). A "maintenance" area is an area a State has redesignated from nonattainment to attainment; accordingly, the State must submit to EPA a plan for maintaining NAAQS as a revision to the SIP.

The candidate sites at Hanford, NTS, INEL, Pantex, ORR, and SRS are within existing attainment areas. Therefore, in regard to these criteria pollutants, the proposed storage and disposition action is not affected by the provisions of this rule.

Toxic air pollutants are addressed in both the Air Quality and Noise sections and the Public and Occupational Health and Safety sections for each of the potential sites. In the Air Quality sections, the maximum concentrations of toxic air pollutants at or beyond the site boundary are compared with the most stringent standard or guidance. VOCs are not addressed because there are no regulatory standards and because they are a secondary source of ozone. In addition, there is a wide variety of VOCs that could be emitted.

For the disposition facilities, the maximum concentrations of hazardous pollutants, including cleaning solvents and hydrocarbons, are also not addressed because there are no regulatory standards. There are a wide variety of cleaning solvents and hydrocarbons available. However, DOE would use cleaning solvents that would reduce the chemical exposure to the public and to workers to the maximum extent possible. Specific cleaning solvents would be identified and analyzed in detail in tiered NEPA documentation. In the Public and Occupational Health and Safety sections, a health risk is calculated based upon chemical concentration, toxicity, and PEL and RfC for non-cancer effects and a cancer risk based on the slope factor (cancer potency) of those compounds that are regulated or carcinogenic.

These differences in analytical method result in the presentation of pollutants that differ between the air quality analysis and public and occupational health analysis. In the air quality analysis, toxic pollutants with low emission rates and high toxicity will, in most cases, result in extremely low concentrations at or beyond the site boundary and are therefore not presented in the air quality analysis. On the other hand, these chemical pollutants may expose an onsite worker located 100 m (328 ft) from the emission source to an unacceptable risk and therefore are presented in the analysis, hence the type and form of data used to evaluate these two areas can and will be different and may require different data sources. For example, compliance to standards neither considers what health effects are expected nor the interaction between several chemicals that may cumulatively cause health responses even if they separately are at acceptable concentrations.

Noise. The acoustical environment both onsite and offsite may be affected during construction and operations of the proposed facilities. Construction and operation noise sources and the potential for onsite and offsite impacts are discussed. The discussion is based on information available on the potential types of noise sources and the location of the proposed facilities relative to the site boundary and noise-sensitive locations. Acoustics impacts are assessed on the basis of the potential degree of change in noise levels at sensitive receptors (for example, residences near the site boundary) with respect to ambient conditions. Most nontraffic noise sources associated with construction and operation of the proposed storage and disposition facilities are located at sufficient distances from offsite noise-sensitive receptors that the contribution to offsite noise levels is expected to be small. The analysis uses available information on the potential types of noise sources and the location of proposed alternative facilities relative to the site boundary and noise-sensitive locations.

4.1.4 WATER RESOURCES

The availability and quality of water resources (surface water and groundwater) and the presence of floodplains may play a significant role in the acceptability of sites for this program. Impacts to water resources at a site could affect surrounding communities as well as the proposed project. Important legislation that protects water resources includes the CWA, especially Sections 402 (NPDES) and 307(b) (Pretreatment Standards), and the SDWA. In addition, DOE regulations 10 CFR 1022, *Compliance with Floodplains/Wetlands Environmental Review Requirements*, which implement Executive Orders 11988 and 11990, require evaluation of the potential effects of their actions in floodplains and wetlands.

Water resources include both surface water and groundwater. The main issues related to water resources include the following: (1) whether there is sufficient water available for both the proposed alternative and local domestic consumption, (2) whether water quality will be degraded or further degraded, (3) whether proposed actions challenge legislative or regulatory compliance, and (4) whether actions are threatened by flooding.

Surface Water Availability. Impact assessment on water availability was analyzed by comparing the rates of water consumption and wastewater discharge during construction and operation of proposed long-term storage and disposition facilities to volumes or use rates for No Action water sources. For sites that obtain water from surface water sources, a comparison was performed for both No Action water use and stream flow. For each storage and disposition alternative, water-use rates for construction and operation activities at each site or for each technology under each option or alternative were taken from technical reports prepared for specialized alternatives. The water use at a site was the sum of water use for waste treatment, storage, or disposal operations. The existing water supply is evaluated to determine its capacity to support an increased demand by comparing a projected increase with the capacity of the supplier and with existing water rights, agreements, and allocations.

The analysis assumed that water for the proposed long-term storage and disposition activities would be withdrawn from the current water source at each site. The surface water, groundwater, or municipal water source is part of the water resources affected and described in Chapter 3. However, at Pantex, the city of Amarillo has offered the use of reclaimed wastewater from the Hollywood Road Waste Treatment Plant as a potential source of water when large water requirements are needed. Where surface water is the current source, surface flow data were also evaluated.

Domestic consumption of regional water supplies by the anticipated workforce is addressed to determine if the projected supply of public water might result in or intensify potential water shortages. The impact assessment methodology presented is applied for all alternatives, including No Action.

Surface Water Quality. The assessment of potential water quality impacts include the type (for example, wastewater effluent, or stormwater runoff, or cooling tower blowdown [rapid discharge of water from the cooling tower to the receiving water body]), rate, and concentrations of potential discharge constituents, including sediment loading. Water quality management practices employed at each site also are reviewed. Parameters with the potential to further degrade existing water quality, along with parameters that could violate existing NPDES permit limits, are identified.

During the construction period, impacts to surface water resources could occur from runoff and sedimentation as a result of site clearing. During operations, impacts to water resources could occur through increased runoff from buildings, parking lots, and cleared areas. These impacts would be proportional to the amount of land disturbed and would be minimized by application of standard management practices for stormwater runoff and erosion control.

During operations, stormwater runoff could be contaminated with materials deposited from airborne pollutants. Impacts from stormwater runoff are expected to be minor, but they are highly site-specific and would depend on the design, precipitation, topography, and surface water body.

Floodplains. Floodplains are identified from maps and existing environmental documents. Any facility operating within a 100-year floodplain, or a critical action within a 500-year floodplain, is analyzed for the environmental consequence to the floodplain. [Text deleted.]

If possible, no new storage or disposition facilities would be located in 100-year or 500-year floodplain areas identified from maps and existing environmental documents. The impacts of disposition activities on floodplains cannot be determined at this time because the specific locations of the disposition facilities for generic sites have not been selected. Therefore, the requirements of Executive Order 11988 (*Floodplain Management*) and 10 CFR 1022 (*Compliance with Floodplain/Wetland Environmental Review Requirements*) would be examined in follow-on NEPA documentation, as appropriate.

Groundwater Availability. Environmental impacts to groundwater availability and usage are determined by addressing the potential change in demand as a result of program activities during the construction and operation phases. Estimates of drawdowns in the affected aquifers, both onsite and offsite, are calculated. Instances are identified where groundwater use may exceed locally developed groundwater supplies. Existing water rights for the major water users, as well as contractual agreements for water supply to the sites from support communities, are summarized. Impacts associated with construction and operation withdrawals are described, including potential effects on existing areas of contaminated groundwater. Withdrawals of groundwater to supply water for the storage and disposition facilities could cause movement of existing groundwater contamination plumes. This could occur where water levels are lowered by withdrawals. If necessary, potential impacts on existing areas of contamination would be evaluated in detail in site-specific environmental documents.

Groundwater Quality. Potential groundwater quality impacts associated with pollutant discharges during construction and operation phases (for example, sanitary wastes) are examined. The results of the groundwater quality projections then are compared to Federal and State groundwater quality standards, effluent limitations, and safe drinking water standards to assess the impacts of each alternative.

4.1.5 GEOLOGY AND SOILS

The geology and soil resource impact analysis consists of an evaluation of the effects generated by the construction and operation of a proposed alternative on specific geologic and soil resource attributes. Construction activities represent the principal means by which an effect to the geologic resource (limiting access to mineral or energy resources) and the soil resource (increasing the potential for soil erosion) would occur. The impact analysis also considers the effects on these attributes resulting from other past, present, and reasonably foreseeable future site improvements within the defined ROI. The principal element in assessing the effect on the geologic and soil resource is the amount and location of land disturbed during construction of the alternative.

Key factors in the impact analysis of geologic and soil resources for the disposition alternatives focus on the amount of land disturbed during construction and operations. For the soil resource impact analysis, the climatic conditions at the sites are considered. Since these key factors varied only slightly for the disposition alternatives, the impact analysis is similar for all alternatives.

Geology. Impact analysis on the geologic resource by a proposed alternative involves the evaluation of potential effects to critical geologic resource attributes such as access to mineral and energy resources, destruction of unique geologic features, vibratory ground motion induced by seismic activity, subsidence induced by groundwater, and mass movement or ground shifting induced by the construction of facilities associated with an alternative. The impact analysis includes the analysis of large-scale geological conditions such as earthquakes, volcanism, geological resources, and sinkhole development. Human health effects from accidents initiated by natural phenomenon (for example, earthquakes) are discussed in the Public and Occupational Health and Safety sections. These conditions tend to affect broad expanses of land and are not typically restricted to smaller discrete areas of land. The analysis of these conditions is provided for the storage alternatives and also applies to the disposition alternatives as appropriate.

Soil. Impact analysis on the soil resource by a proposed alternative involves the evaluation of potential effects to specific soil attributes such as soil erosion and shrink-swell potential by construction activities. [Text deleted.] Affects to the soil resource occur to small, discrete areas of land. The impact analysis for the soil resource is provided for each alternative.

4.1.6 BIOLOGICAL RESOURCES

During construction of storage and disposition facilities, impacts to biological resources may result from land-clearing activities, erosion and sedimentation, human disturbance and noise, and dewatering of foundations. Operations may affect biological resources as a result of changes in land use, salt drift from cooling systems, emissions of radionuclides, water withdrawal, wastewater discharge, and human disturbance and noise. In general, potential impacts are assessed based on the degree to which various habitats or species could be affected by an alternative. Where appropriate, impacts are evaluated with respect to Federal and State protection regulations and standards. The ROI for site-specific alternatives includes the entire DOE site under consideration, while the ROI for non-site-specific alternatives includes conditions representing various regions of the United States within which the alternative could be located.

Terrestrial Resources. Impacts of project activities on terrestrial plant communities are evaluated by comparing data on site or regional vegetation communities to proposed land requirements for both construction and operation. The analysis of impacts to wildlife is based to a large extent on plant community loss or modification, which directly affects animal habitat. The loss of important or sensitive habitats and species is considered more important than the loss of a regionally abundant type. Where alternatives are associated with specific sites, the disturbance, displacement, or loss of wildlife is evaluated. Migratory birds are discussed in a broader sense where alternatives are not site-specific, since they encompass a wide geographic area. Alternatives that may cause salt deposition are identified. [Text deleted.] Impacts on biotic resources from the release of radionuclides would be expected to be less than that on the human population. Humans have generally been shown to be the most sensitive organism to radiation release (AEC 1968a:220; NAS 1972a:34); radiological effects on humans are addressed in the human health sections.

Wetlands. The potential direct loss of wetlands resulting from construction and operation of storage and disposition facilities is addressed in a similar fashion as for terrestrial plant communities, that is, by comparing data on site or regional wetlands to proposed land requirements. Sedimentation impacts are evaluated based on the proximity of wetlands to project areas and the knowledge that erosion and sedimentation controls will be required. Where alternatives are site-specific, impacts resulting from increased flows are evaluated based on a relative comparison of expected discharge rates with stream flow rates. Impacts resulting from the introduction of thermal and chemical pollution into a wetland system are addressed recognizing that effluents are required to meet Federal and State standards. DOE regulations concerning proposed actions in wetlands (10 CFR 1022) were also considered.

Aquatic Resources. Impacts to aquatic resources resulting from sedimentation, increased flows, and the introduction of waste heat and chemicals are evaluated as described for wetlands. Potential impacts from radionuclides are not addressed for the same reasons described for terrestrial resources. Where alternatives are site-specific, impingement and entrainment impacts are evaluated based on a relative comparison of stream flow and intake volumes, recognizing that when intake volumes represent a large percentage of stream flow, the possibility of impingement and entrainment impacts exists. Compliance with protective measures, such as the *Anadromous Fish Conservation Act* (Appendix J), are addressed, as appropriate.

Threatened and Endangered Species. Impacts on threatened and endangered species are determined in a manner similar to that described for terrestrial and aquatic resources because the sources of potential impacts are similar. A list of species potentially present on each site or in each region was developed using information obtained from the USFWS, National Marine Fisheries Service, and appropriate State agencies and site-specific reports. This list, along with consideration of site environmental and engineering data, is used to evaluate

whether the various alternatives could impact any threatened or endangered plant or animal (or its habitat). Consultations with USFWS and State agencies would be conducted at the site-specific level, as appropriate.

4.1.7 CULTURAL AND PALEONTOLOGICAL RESOURCES

The cultural and paleontological resources impact analysis evaluates the potential effects of the construction and operation of a proposed alternative on prehistoric, historic, Native American, and paleontological resources. Appropriate information regarding cultural resources includes the possibility that NRHP-eligible sites or important Native American resources may be affected, as well as the procedures for successful completion of the NHPA Section 106 identification or mitigation process. Section 106 requires Federal agencies to take into account the effects of their activities and programs on NRHP-eligible properties. Section 106 procedures include identification of resources, evaluation for NRHP eligibility, assessment of project effects, preservation or mitigation of affected eligible resources, and coordination and consultation with the appropriate SHPO and the Advisory Council on Historic Preservation.

Compliance with the *American Indian Religious Freedom Act* and the *Native American Graves Protection and Repatriation Act* is also part of the regulatory process. These acts require that consultation with interested Native American groups be initiated as part of the compliance process.

Information collected to identify relevant cultural and paleontological resources includes the general prehistory and history of a region, results of previous cultural or paleontological resources surveys or studies within or near the affected project area, and identification of any resources eligible for or currently on the NRHP, or part of the National Natural Landmarks Program.

Impacts to prehistoric and historic resources are postulated if alternatives could substantially add to existing disturbance of resources in the project areas, could affect NRHP-eligible resources, or could cause loss or destruction of important scientific, cultural, or historic resources. Impacts to Native American resources are postulated if alternatives have the potential to affect sites important for their position in the Native American physical universe or religion, or to reduce access to traditional use areas, plant or animal communities, or sacred sites. Impacts to paleontological resources are postulated if alternatives could affect deposits with high research potential.

[Text deleted.] On a programmatic level specific detail on the types and locations of resources within the proposed project areas is not available for all locations, and the level of detail varies by facility or alternative. General information concerning site types and NRHP eligibility of those types in the region, however, is appropriate for the PEIS. At the site-specific level and depending on the alternative, more detailed information may be required including file investigations, Native American consultation, implementation of the DOE American Indian Policy, or predictive modeling to determine the types, numbers, locations, and NRHP eligibility or importance of cultural resources in the proposed project area.

4.1.8 SOCIOECONOMICS

The socioeconomic impact analysis assesses the environmental consequences of demographic and economic changes resulting from implementing a proposed alternative. Developing a new facility or adding new operations to an existing DOE or commercial facility may create new jobs. The creation of new jobs may affect the economy of the regional economic area and may place an increased demand on housing, community services, and local transportation within the ROI, if the local labor market is unable to meet the labor requirements. Therefore, this study assesses the potential impacts of each proposed alternative on these characteristics. The socioeconomic environment is defined for two geographic regions: the REA and the ROI. REAs are used to assess potential effects on the regional economy, and ROIs are used to assess effects that are more localized in political jurisdictions surrounding the sites.

The REA for each site encompasses a broad market that involves trade among and between regional industrial and service sectors and is characterized by strong economic linkages between the communities in the region. These linkages determine the nature and magnitude of multiplier effects of economic activity (purchases, earnings, and employment) at each site. REAs are defined by BEA and consist of an economic node that serves as the center of economic activity and the surrounding counties that are economically related and include the places of work and residences of the labor force.

Potential demographic impacts were assessed for the ROI, a smaller geographic area where the housing market and local community services would be the most affected. Site-specific ROIs were identified as those counties where approximately 90 percent of the current DOE and/or contractor employees reside. This residential distribution reflects existing commuting patterns and attractiveness of area communities for people employed at each site and is used to estimate the future distribution of in-migrating workers.

The following sections summarize the methodology used for assessing the potential socioeconomic impacts from the alternatives.

Baseline Comparisons. Data on the current socioeconomic conditions were compiled for each ROI and REA. The data were then projected out to the period of full operation for the alternatives based on population forecasts developed by BEA. These projections were compared with the estimates of project-related impacts.

Proposed project alternatives may require additional workers during the construction and operation phases. An analysis of the projected labor availability was performed to determine the number of workers that may in-migrate to the region to meet employment needs. In addition to jobs and income directly created by the proposed project alternatives, other jobs and income may be created indirectly within the REA. These indirect jobs and resulting income are measured by employing the most recent version of the Regional Input-Output Modeling System developed by the BEA.

Population increases due to in-migration of new workers and their families are estimated by the number of new workers and the national average household size. The national average is used because the new population would come from unknown locations outside the region.

The impact on community services is assessed by determining the increase in each community service required to maintain the level of service that currently exists within the ROI, such as student-to-teacher ratio, police officer-to-population ratio, and hospital capacity.

Local Transportation. Traffic impacts are modeled using a proprietary transportation model developed in accordance with the *Highway Capacity Manual* methodology for freeways, multilane roads, and two-lane roads. Average Annual Daily Traffic (AADT) volumes are projected for 1995 and the impact year using No Action population projections.

The AADT for impacts beyond the No Action alternative are calculated from the direct employment and direct in-migrating population associated with each alternative. Only roads in the vicinity of the site on which at least 5 percent of workers travel were modeled. It was assumed that any additional workers required for a proposed alternative would use the same roads as the current workforce.

Service flow, the maximum hourly rate at which vehicles can reasonably be expected to cross a point or uniform section of a lane during a given time period under current roadway and traffic conditions, is calculated for the road segments. Capacity of the road segments is calculated from the number of lanes and capacity per lane. The service flow equation is solved for the volume-to-capacity ratio.

Level of service is a measure describing operational conditions within a traffic stream. A level of service describes these conditions in terms of factors such as speed and travel time, freedom to maneuver, traffic interruptions, comfort and convenience, and safety. The level of service designations range from A to F, with each level defined by a range of volume to capacity ratios. The level of service designations, given in Table 4.1.8-1, are based primarily on the *Highway Capacity Manual* Special Report 209.

Table 4.1.8-1. Level of Service Letter Designations and Definitions

Letter Designation	Operating Conditions	Level of Service Definition
A	Good	This is a condition of free flow, accompanied by low volumes and high speeds.
B	Good	This occurs in the zone of stable flow, with operating speeds beginning to be restricted somewhat by traffic conditions.
C	Good	This is still in the zone of stable flow, but speeds and maneuverability are more closely controlled by the higher volumes.
D	Below average	This level of service approaches unstable flow, with tolerable operating speeds maintained, though considerably affected by changes in operating conditions.
E	Maximum capacity	This cannot be described by speed alone, but represents operations at lower operating speeds, typically, but not always, in the neighborhood of 30 miles per hour, with volumes at or near the capacity of the highway.
F	Traffic jam	This describes a forced-flow operation at low speeds, where volumes are above capacity.

Source: National 1985a.

4.1.9 PUBLIC AND OCCUPATIONAL HEALTH AND SAFETY

The scope of the public and occupational health and safety analysis includes a determination of effects on human health that result from exposures to ionizing radiation and hazardous chemicals. Storage and disposition alternatives addressed in this PEIS use a broad variety of processes involving both radioactive and chemical materials that can be hazardous to human health. The degree of hazard is directly related to the type and quantity of the particular radioactive or chemical material to which a person is exposed. The health effects that may be associated with radiation and chemical induction of cancer are determined by estimating the radiological and chemical doses to workers and the general public that result from these exposures. The risk from these doses is then converted to potential cancers. This is done for normal operations and postulated accident scenarios. Additionally, for hazardous chemicals, a Hazard Quotient (HQ) is calculated based on the exposure concentration of each chemical; the HQs are calculated for all known noncancer adverse effects. The HQs are then summed to obtain the Hazard Index (HI) for each operation at a given site. The HI is used as an indicator of safe exposure levels to avoid noncancer effects of an acute or chronic nature, and is independent of the cancer risk. More detailed information about the public and occupational health safety analysis for this PEIS is found in Appendix M.

Computer models and operational histories are used to predict the impacts on the health of workers and the public due to both normal operation and postulated accidents. The computer models include GENII and Melcor Accident Consequence Code System (MACCS) for airborne and liquid radioactive releases during normal operation and accident conditions, respectively; and ISCST2 for hazardous chemical releases.

Since direct chemical monitoring data on worker exposure is not available for specific operations, the onsite worker is assumed to receive the maximum exposure that any involved (the workers directly involved in the proposed facility) or noninvolved (the workers onsite but not directly involved in the proposed facility) onsite person will receive. OSHA-regulated levels (that is, the PEL) are applied to all hazardous chemicals that are released at the site. This includes both the process-specific releases as well as those that are a result of other site operations. All onsite exposures are assumed to occur at a distance of 100 m (330 ft) from a centralized point of release, which will yield a conservative concentration level for each chemical. The concentrations are derived through the ISCST 2 model recommended by EPA. The noncancer risks to the MEI of the public consist of HQs that compare chemical exposure levels to the RfC values published by EPA in the Integrated Risk Information System (IRIS). For the onsite worker, the HQ values are calculated by comparing the calculated chemical exposure levels to the PEL established by OSHA. The HI for either the MEI or the onsite worker is the sum of the HQs for every hazardous chemical analyzed. If the HIs are 1.0 or less, then the noncancer regulated levels for all hazardous chemicals have been met and no health effects are expected.

The lifetime cancer risk to the MEI and the onsite worker from exposure to a carcinogenic chemical can be derived from either of the two following ways. The calculated exposure dose in mg/kg of body weight is multiplied by that individual chemical's slope factor published in EPA's IRIS or the EPA's yearly published Health Effects Summary Tables (HEAST), or the exposure concentration in mg/m³ is multiplied by unit risk (found in IRIS or HEAST) to give the lifetime cancer risk. Only carcinogenic chemicals will have slope factors and/or unit risk values. The cancer risk coming from all carcinogenic chemicals is derived by summing up the risks from all individual carcinogenic chemicals.

The chemical pollutant exposures to the public are considered to be for 24 hours a day, 52 weeks per year, and 70 years for a lifetime. The worker exposure is based on an 8-hour day and 52 weeks of 40 hours each (0.237 fractional year). The HI values and cancer risks are conservative because all emissions are assumed to come from a centralized source term. The cancer risks to the noninvolved worker for each chemical are computed from the dose (converted from air concentrations) and the unit risk or slope factors to yield a probable risk. The risks are also conservative because a single point at or near the maximum onsite concentration is selected for exposure of the noninvolved facility worker. Actual risks are likely lower than estimated risks.

The HI is the sum of the HQs for every hazardous chemical analyzed, the HQ being the ratio of the actual (or calculated) concentration to the regulated concentration value. Even if OSHA PELs and EPA RfCs for several hazardous chemicals are met, but they affect the same target organ or tissue, they may be expected to collectively cause injury or ill health because their damage will be cumulative. Thus, an HI of much greater than 1.0 is meaningful because the sum of the effects has the same effect as that of a single hazardous chemical exceeding the OSHA PEL or the RfC. The HI and HQ are not regulated values, but serve to assess whether regulated values have been met and whether there is a potential for a detrimental health effect to occur.

Toxic air pollutants are addressed in the Air Quality and Noise sections and the Public and Occupational Health sections for each of the potential sites. In the Air Quality sections, the maximum concentration of toxic air pollutants at or beyond the site boundary are compared with a standard to determine compliance. In the Public and Occupational Health sections, a health risk is calculated based upon chemical concentration, toxicity, and PEL or RfC for noncancer effects and a cancer risk based on the slope factor (cancer potency) of those compounds which are regulated or carcinogens.

These differences in analytical method result in the presentation of pollutants that differ between the air quality analysis and public and occupational health analysis. In the air quality analysis, toxic pollutants with low emission rates and high toxicity will, in most cases, result in extremely low concentrations at or beyond the site boundary and are therefore not presented in the air quality analysis. On the other hand, these chemical pollutants may expose an onsite worker located 100 m (330 ft) from the emission source to an unacceptable risk, and therefore are presented in the analysis. Hence, the type and form of data used to evaluate these two areas can and will be different and may require different data sources.

The assessments use technology-specific releases of radioactivity and hazardous chemicals and site-specific factors such as meteorology, population distribution, agricultural production, and an assumed facility location on the site. Atmospheric dispersion modeling performed for the Air Quality section is also utilized to develop exposure concentrations in the evaluation of impacts to workers from hazardous chemicals.

A discussion of calculational uncertainties is included to provide an understanding of how the various steps of an impact analysis can lead to predictions different from those presented in this PEIS. However, efforts have been made in all assessments to choose conservative assumptions and parameters so that impacts are not underestimated. Further discussions of assessment methodologies, including values of parameters used in the various computer models, are presented in Appendix M.

Health Impacts on Plant Workers During Normal Operation. Because radiation workers are individually monitored, experiences from past and current operations that are similar to future operations are used to estimate the radiological doses to workers directly involved with fissile material storage and disposition activities. Doses are also determined for noninvolved workers (that is, workers who are onsite but not involved with the proposed storage and disposition activities).

Radiological doses are converted to health effects using appropriate health risk estimators. Health effects from chemicals are predicted by applying appropriate risk estimators to modeled concentrations. Radiological and chemical impacts are also compared with applicable regulatory compliance and guidance requirements. The health risk estimators and applicable standards are presented and discussed in detail in Appendix M.

Health Impacts on the Public During Normal Operation. Public health impacts could result from exposure to radioactive or hazardous chemical materials released during operation. The effect is the sum of internal exposure resulting from breathing air, eating food, and drinking water; and of external exposure from standing on contaminated ground, being exposed to the air, and being submerged in water.

Impacts to the MEI and to the population around each site are calculated. The differences in impacts among the various sites are the result of many site-specific factors including the distance to the site boundary, the population distribution, and meteorological dispersion.

Modeling is used to estimate the type and amount of material released and the associated radiological doses and chemical concentrations and doses. The predictive models used to calculate radiological doses have been found to give results that tend to be higher than if calculated by converting actual measured concentrations to doses. The radiological doses and the chemical doses and concentrations are converted to health effects using appropriate health risk estimators. Radiological doses, chemical concentrations, and health risks are compared with regulatory limits and, for perspective, with background levels in the vicinity of the site. The health risk estimators used in the assessments and the applicable regulatory standards are presented and discussed in detail in Appendix M.

Accident Analysis for Postulated Accident Scenarios. The relative consequences of postulated accidents are considered in the evaluation of each alternative. In evaluating the magnitude and consequences of each alternative, accident analysis is performed. The concepts used are analogous to a formal Probabilities Risk Assessment, which would be appropriate for a project-level analysis, although the accident analysis involves considerably less detail for programmatic decision-making. The accident analysis addresses only a spectrum of bounding accidents (high consequence, low probability) and a representative spectrum of possible operational accidents (low consequence but high probability of occurrence). The technical approach for the selection of accidents is consistent with the DOE Office of NEPA Oversight *Recommendations for the Preparation of Environmental Assessments and Environmental Impact Statements* (May 1993) guidance that recommends consideration of two major categories of accidents: within design basis accidents (also referred to as evaluation basis accidents) and beyond design basis accidents (also referred to as beyond evaluation basis accidents).

For the purpose of this assessment, risk is defined as the mathematical product of the probability and consequence of an accident. The risk-contributing scenarios consider both evaluation basis and beyond evaluation basis accidents. The specific accidents consider the types of facilities. Examples of accidents include those resulting from operator errors, spills, criticalities, fire, explosions, airplane crashes, common-cause failures, severe weather, earthquakes, and transportation. Information on potential accidents includes those that have been postulated and analyzed for similar facilities. The risks of the various storage and disposition facilities are evaluated in terms of the incremental increase in risk from postulated accidents with respect to normal day-to-day risks to which the general population is exposed.

For each alternative, a number of evaluation basis and beyond evaluation basis accidents have been identified and are analyzed to define the accident consequences and risks. Evaluation basis accidents are generally in a frequency range of greater than 10^{-6} per year, while beyond evaluation basis accidents are generally in a frequency range of 10^{-7} to 10^{-6} per year. In some cases, accidents less than 10^{-7} are included in the set of beyond evaluation basis accidents when their impacts are relevant to decisionmaking.

Uncertainties. The sequence of analyses performed to generate the radiological and hazardous chemicals impacts estimates from normal operation and facility accidents include (1) selection of normal operational modes and accident scenarios and their probabilities, (2) estimation of source terms, (3) estimation of environmental transport and uptake of radionuclides and hazardous chemicals, (4) calculation of radiation and chemical doses to exposed individuals, and (5) estimation of health effects. There are uncertainties associated with each of these steps. Uncertainties exist in the way the physical systems being analyzed are represented by the computational models and in the data required to exercise the models (due to measurement errors, sampling errors, or natural variability).

Of particular interest are the uncertainties in the estimate of cancer deaths from exposure to radioactive materials. The numerical values of the health risk estimates used in this PEIS (refer to Appendix M) were

obtained by the practice of linear extrapolation from the nominal risk estimate for lifetime total cancer mortality at 10 rad. Other methods of extrapolation to the low-dose region could yield higher or lower estimates of cancer deaths. Studies of human populations exposed at low doses are inadequate to demonstrate the actual level of risk. There is scientific uncertainty about cancer risk in the low-dose region below the range of epidemiological observation, and the possibility of no risk or even health benefits (hormesis effects) cannot be excluded. Because the health risk estimators are multiplied by conservatively calculated radiological doses to predict fatal cancer risks, the fatal cancer values presented in this PEIS are expected to be overestimates.

The widely used algorithms for estimating the risk of latent cancers from radiation are based on high dose rates, and the impacts are then extrapolated to low rates by presumed linear response models. These models are known to overestimate the risk for low dose rates, and the actual risk may be zero.

For the purposes of presentation in this PEIS, the impacts calculated from the linear model are treated as an upper bound case, consistent with the widely used methodologies for quantifying radiogenic health impacts. This does not imply that health effects are expected. Moreover, in cases where the upper bound estimators predict a number of latent cancer deaths that is greater than 1, this does not imply that the latent cancer death(s) are identifiable to any individual.

Uncertainties are also introduced when accident analyses performed for similar existing facilities have been used as a major source of data. Although the radionuclide composition of source terms are reasonable estimates, there are uncertainties in the radionuclide inventory and release fractions that affect the estimated consequences. Accident frequencies for low probability sequences of events are always difficult to estimate, even for operating facilities, because there is little or no record of historical occurrences. For a new facility, such as a Pu storage facility or an LWR for Pu disposition, any use of accident frequencies that are estimated from similar existing facilities would tend to further compound the effects of uncertainties. There are also uncertainties attributed to information for designs that are in the conceptual stage.

In summary, the radiological and hazardous chemical impact estimates presented in this document were obtained by:

- Using the latest available data
- Considering the processes, events, and accidents reasonably foreseeable for the storage and disposition facilities described in this PEIS
- Making conservative assumptions when there is doubt about the exact nature of the processes and events taking place, such that the chance of underestimating health impacts is small.

4.1.10 WASTE MANAGEMENT

Waste management facilities that support the long-term storage or disposition of weapons-usable fissile materials would treat and package all waste generated in support of this activity into forms that enable long-term storage and/or disposal in accordance with the *Atomic Energy Act* (AEA), RCRA, and other applicable statutes as outlined in Section E.1.2. The preconceptual designs of the new facilities provide their own waste treatment capability and incorporate waste minimization and pollution prevention practices.

Since any changes in wastes volumes could have an impact on the existing and projected waste activities at DOE sites, the PEIS assesses the impacts on waste management from the waste streams generated by all alternatives, including the No Action Alternative. All alternatives would be required to fully comply with all current applicable regulations. The waste management assessment is very important to the overall DOE decisionmaking process and is being coordinated with EM, which evaluates alternatives for implementing an integrated waste management program. The Draft Waste Management PEIS (DOE/EIS-0200-D) focuses on waste management strategies required to treat, store, or dispose of existing wastes and wastes that will be generated in the future as a result of DOE operations. The Draft Waste Management PEIS also evaluates the environmental impacts of transporting wastes. [Text deleted.]

Waste management activities that would support the long-term storage or disposition of weapons-usable fissile materials program are assumed to be per current site practices and are contingent upon decisions to be made through the Waste Management PEIS. Any future waste management facilities that may be required to support the long-term storage or disposition of weapons-usable fissile materials program would be coordinated with any decisions resulting from the Waste Management PEIS and any respective site-specific NEPA documentation. For example, depending on decisions in the waste-type-specific RODs for the Waste Management PEIS and in subsequent waste-type-specific RODs and NEPA documents, wastes could be treated and disposed of onsite or at regionalized or centralized DOE sites.

The construction and operation of facilities to support the storage and disposition of weapons-usable fissile material program would generate spent nuclear fuel and several types of wastes, depending on the alternative. [Text deleted.] Construction wastes would be similar to those generated by any construction project of comparable scale. Spent nuclear fuel and the following waste categories are analyzed: TRU, mixed TRU, low-level, mixed low-level, hazardous, and nonhazardous. This PEIS also analyzes the management and onsite storage of wastes and spent nuclear fuel, until DOE either disposes of the wastes or places them in long-term retrievable storage. To provide a framework for addressing the impacts of waste management, descriptive information is presented on waste management activities anticipated for each DOE site and for each storage or disposition alternative. Operational waste generation and effluent data are estimated and vary according to the storage or disposition technology and site. These estimates have included waste minimization provisions. The impact assessment compares the projected waste type and waste volume generation from the various disposition facilities at each site with that of the No Action Alternative. Impacts are assessed in the context of existing site practices for treatment, storage, and disposal, including current Federal, State, and local regulations and agreements.

The number of TRU waste shipments to WIPP (depending on decisions from the Supplemental EIS for the disposal phase of WIPP) was estimated by using data in the *Comparative Study of Waste Isolation Pilot Plant Transportation Alternatives* (DOE/WIPP 93-058). From this report, the PEIS uses 8.7 m³ (11.4 yd³) per truck shipment, 17.5 m³ (22.9 yd³) per regular train shipment, and 52.4 m³ (68.6 yd³) per dedicated train shipment (rail shipment may not be applicable at all sites). DOE sites used in the analysis (with the exception of Pantex) either have, or have planned, an onsite LLW disposal facility. As discussed in Section E.1.4, land-usage factors for the disposal of LLW were developed from data in the DOE Integrated Data Base Program for each existing DOE LLW disposal facility (Hanford, INEL, NTS, and SRS). For the proposed Class II LLW disposal facility at ORR, a 3,300 m³/ha (1,700 yd³/acre) usage factor was assumed (OR DOE 1995e:1). For the purposes of this

PEIS, it was assumed that all LLW generated at Pantex would be shipped to NTS per current practice. The number of additional shipments required to transport LLW from the site to a DOE LLW disposal facility is estimated. A typical shipment was assumed to consist of eighty 208-l (55-gal) drums, which results in a total shipment volume of approximately 16.6 m³ (21.7 yd³). The risks associated with additional shipments are addressed as part of the intersite transportation assessment.

Under some PEIS alternatives, specific candidate sites are not identified. As a result, no planning or environmental documents are available to provide descriptions of the waste management activities or to establish a detailed baseline from which environmental consequences can be estimated. For these cases, generic environmental baselines are presented to define conditions. Waste management impacts are assessed by analyzing the specific waste management facilities and activities associated with the alternative that are necessary to locate new missions at the unspecified sites.

4.2 NO ACTION ALTERNATIVE AND LONG-TERM STORAGE ALTERNATIVES

This section describes the potential environmental consequences of the No Action Alternative and of constructing and operating various long-term storage alternatives. A key for locating information on the storage alternatives and candidate sites analyzed is shown in Table 4-1. Included in the analysis of each site is storage phaseout. The phaseout of Pu storage at Hanford, INEL, Pantex, SRS, RFETS, and LANL, and HEU storage at ORR, is a common activity associated with both storage and disposition when the storage requirements for these fissile materials are eliminated at a particular site. The impact analysis in this section is organized by site.

4.2.1 HANFORD SITE

A listing of the proposed long-term storage alternatives, subalternatives, and related actions, including the No Action Alternative, at Hanford is provided below. The potential impacts of implementing these alternatives and related actions at Hanford are described in the following sections: land resources, site infrastructure, air quality and noise, water resources, geology and soils, biological resources, cultural and paleontological resources, socioeconomics, public and occupational health and safety, and waste management. The specific long-term storage alternatives proposed for Hanford are the Upgrade Alternative, the Consolidation Alternative, and the Collocation Alternative.

Preferred Alternative

No Action Alternative:

Continue to store Hanford Pu material within the scope of this PEIS in the PFP in stabilized form pursuant to DNFSB Recommendation 94-1.

Proposed Storage Activities at Hanford Site

- **No Action Alternative (Preferred Alternative):** Continue to store Hanford Pu material within the scope of this PEIS in the PFP in stabilized form pursuant to DNFSB Recommendation 94-1.
- **Upgrade Alternative:** There are two subalternatives under this storage alternative.
 - ***Upgrade Without RFETS Pu or LANL Pu Subalternative:*** Two options to accommodate Hanford Pu material: Modify selected areas of FMEF in 400 Area; or construct a new facility in 200 West Area.
 - ***Upgrade With All or Some RFETS Pu and LANL Pu Subalternative:*** Two options to accommodate Hanford, RFETS and LANL Pu material: Increase modification of selected areas of the FMEF in 400 Area; or construct a larger new facility in 200 West Area.

Proposed Storage Activities at Hanford Site—Continued

- **Consolidation Alternative:** Construct a new facility adjacent to 200 East Area to accommodate all Pu material within the scope of this PEIS.
- **Collocation Alternative:** Construct a new facility adjacent to 200 East Area to accommodate all Pu and HEU material within the scope of this PEIS.
- **Subalternatives Not Including Strategic Reserve and Weapons Research and Development Materials:** Facility and other resource requirements would be smaller than the Upgrade With All or Some RFETS Pu and LANL Pu subalternatives, the Consolidation Alternative, and the Collocation Alternative.
- **Phaseout:** Hanford Pu material within the scope of this PEIS would be moved out of Hanford to the Consolidation or Collocation site (located at another DOE site) or to disposition (for surplus Pu).

4.2.1.2 Site Infrastructure

For selected site infrastructure parameters, Table 4.2.1.2–1 shows the site availability, projected usage under No Action, and projected usage associated with each storage alternative at Hanford, including phaseout of the Pu storage mission. Adequate infrastructure is available to accommodate all long-term storage alternatives. In addition, there is adequate space for any new facilities required to support the various storage alternatives.

Preferred Alternative: No Action Alternative

The infrastructure currently in place at Hanford is capable of handling all anticipated missions and functions associated with the No Action Alternative. However, certain actions could result in changes to the site infrastructure under No Action. Some of these actions are described below. Since the PFP processing facilities (234-5Z) were designed and constructed in 1947, it is reasonably foreseeable that upgrades of the PFP and support services/utilities could be required to complete stabilization and packaging activities for the current inventory of weapons-usable Pu. These activities are described in the *Hanford Site Integrated Stabilization Management Plan* (SISMP). In addition, glovebox-scale processing and a new packaging capability are required to implement the DOE-STD-3013-94 storage standard in SISMP timeframes.

In the PFP-EIS, DOE has assessed impacts of activities required at Hanford to remove and stabilize readily retrievable Pu residues in the nonstorage portions of the PFP (that is, 234-5Z processing facility) while its current material storage capability is maintained. The actions resulting from the PFP-EIS could affect certain site infrastructure parameters. Hanford will continue to evaluate low-assay, non-weapons usable, Pu materials currently in storage for potential treatment, packaging, and disposal as TRU waste to WIPP to avoid unnecessary costs, handling, and personnel exposure. [Text deleted.]

There could be additional changes to Hanford's site infrastructure under No Action resulting from construction of safe, environmentally sound, and economic, dry interim storage of the K-East Basin (105-KE Basin) spent fuel. The Hanford SISMP outlines plans to remove the spent nuclear fuel from the 105-KE Basin by December 1999. Such removal will resolve the safety and environmental concerns identified in DNFSB Recommendation 94-1 that are associated with the deteriorating spent fuel in the 105-KE Basin and would occur under No Action.

Upgrade Alternative

Upgrade Without Rocky Flats Environmental Technology Site Plutonium or Los Alamos National Laboratory Plutonium subalternatives

Modify Existing Fuels and Materials Examination Facility for Plutonium Storage

Modifying selected areas of the FMEF to accommodate long-term storage of existing quantities of Pu at Hanford would not affect the site infrastructure. Data for construction are presented in Appendix C. Operations impacts to the Hanford infrastructure under this option would be minimal. This is because the FMEF is a fully capable nuclear materials facility with the required infrastructure, including access roads, in place. All infrastructure requirements for this subalternatives are within site capacities.

Construct New 200 West Area Facility for Plutonium Storage

Constructing a new storage facility to accommodate long-term storage of existing quantities of Pu at Hanford would not impact the site infrastructure. Data for construction are presented in Appendix C. Operations impacts to the Hanford infrastructure under this subalternatives would be minimal. [Text deleted.] As shown in Table 4.2.1.2–1, less than 5 km (3 mi) of roads would need to be constructed. All other infrastructure requirements are within site capacities.

Upgrade With All or Some Rocky Flats Environmental Technology Site Plutonium and Los Alamos National Laboratory Plutonium subalternatives***Modify Existing Fuels and Materials Examination Facility for Plutonium Storage***

Construction to modify selected areas of the FMEF to accommodate existing quantities of Pu plus material relocated from RFETS and LANL would not impact the site infrastructure. Data for construction are presented in Appendix C. Operations impacts under this option would also be minimal. Requirements are within site capacities and would not impact the site infrastructure.

Since impacts associated with this option for storing all of the RFETS Pu and LANL Pu material at Hanford are minimal, storing only a portion of the RFETS Pu and LANL Pu material at Hanford would result in minimal impacts to the site infrastructures as well. Additional annual electrical energy requirements would be proportionately less than that required for storage of the full amount of RFETS Pu and LANL Pu material.

Construct New 200 West Area Facility for Plutonium Storage

Constructing a new storage facility to accommodate existing quantities of Pu plus material relocated from RFETS and LANL would not impact the site infrastructure. Data for construction are presented in Appendix C. Operations impacts under this option would also be minimal. Requirements are within site capacities and would not impact the site infrastructure. Less than 5 km (3 mi) of access road would need to be constructed.

Since impacts associated with this option for storing all of the RFETS Pu and LANL Pu material at Hanford are minimal, storing only a portion of the RFETS Pu and LANL Pu material at Hanford would result in minimal impacts to the site infrastructures as well. Additional annual electrical energy requirements would be proportionately less than that required for storage of the full amount of RFETS Pu and LANL Pu material.

Consolidation Alternative***Construct New Plutonium Storage Facility***

The site infrastructure impacts of constructing a consolidated Pu storage facility at Hanford would be minimal. Data for this construction are located in Appendix C. The site infrastructure impacts of operating a consolidated Pu storage facility at Hanford are shown in Table 4.2.1.2–1. The Hanford site infrastructure would be fully capable of supporting the operations of such a new facility without major modifications to the existing site infrastructure and utility resource requirements. Less than 5 km (3 mi) of access road would need to be constructed.

Collocation Alternative***Construct New Plutonium and Highly Enriched Uranium Storage Facilities***

The site infrastructure impacts of constructing consolidated Pu and collocated HEU storage facilities at Hanford would be minimal. Data for this construction are located in Appendix C. The site infrastructure impacts of operating consolidated Pu and collocated HEU storage facilities at Hanford are shown in Table 4.2.1.2–1. Hanford site infrastructure would be fully capable of supporting the operations of such new facilities without major modifications to the existing site infrastructure and utility resource requirements. Less than 5 km (3 mi) of access road would need to be constructed.

Subalternatives Not Including Strategic Reserve and Weapons Research and Development Materials

Since the existing Hanford site infrastructure would be fully capable of supporting construction/modification and operation of facilities for the Upgrade Alternative (both subalternatives), the Consolidation Alternative, and the Collocation Alternative, constructing and operating such facilities without including provisions for storage of strategic reserve and weapons R&D materials could be accommodated as well. Expected reductions in amounts of annual electrical energy requirements from those of the various storage alternatives for all the strategic reserve and weapons R&D materials are the only site infrastructure changes expected if this subalternatives is chosen because electric usage is dependent on the amount of material. [Text deleted.]

Phaseout

Phaseout of the Pu storage mission at Hanford would have no impact on the facilities and site infrastructure. While Pu storage operations would cease, the storage facilities would remain and utility service would continue at about the same usage level until D&D is accomplished.

4.2.1.3 Air Quality and Noise

Construction and operation activities associated with the No Action Alternative and the proposed storage alternatives would generate criteria and toxic/hazardous pollutants. To evaluate the air quality impacts at Hanford, criteria and toxic/hazardous concentrations from the No Action Alternative and the proposed storage alternatives are compared with Federal and State standards and guidelines. Impacts to human health from radiological and chemical airborne emissions are described in Section 4.2.1.9.

In general, all of the proposed storage facilities would emit the same types of air pollutants during construction. It is expected emissions would not exceed Federal, State, or local air quality regulations. PM₁₀ and TSP concentrations will be increased, especially during peak construction periods.

The principal sources of emissions during construction include the following:

- Fugitive dust from land clearing, site preparation, excavation, and wind erosion of exposed ground surfaces
- Exhaust and road dust generated by construction equipment, vehicles delivering construction materials, and vehicles carrying construction workers

During operation, impacts from each of the individual storage facilities with respect to the concentrations of criteria and toxic/hazardous air pollutants are predicted to be in compliance with Federal, State, and local air quality regulations or guidelines. Table 4.2.1.3–1 presents the estimated pollutant concentrations for each of the proposed storage alternatives, indicating little difference between alternatives with respect to impacts to air quality.

Emission rates attributed to operation of the proposed storage facilities are presented in Tables F.1.3–1 to F.1.3–3. [Text deleted.] Air pollutant emission sources associated with operations include the following:

- Operation of boilers for space heating
- Operation of diesel generators and periodic testing of emergency diesel generators
- Exhaust and road dust generated by vehicles delivering supplies and bringing employees to work
- Toxic/hazardous pollutant emissions from facility processes

Noise impacts during either construction or operation are expected to be low. Air quality and noise impacts for each storage alternative are described separately. Supporting data for the air quality and noise analyses are presented in Appendix F.

AIR QUALITY

An analysis was conducted of the potential impacts on air quality from emissions from each of the storage alternatives described in Section 2.2.1.

Section 176 (c) of the 1990 CAA Amendments requires that all Federal actions conform with the applicable SIP. The EPA has implemented rules that establish the criteria and procedures governing the determination of conformity for all Federal actions in nonattainment and maintenance areas. These are discussed in Section 4.1.3. The attainment status of the area in which Hanford is located is discussed in Section 3.2.3. Since the area is considered to be an attainment area for the criteria pollutants, the proposed actions at this site do not require that a conformity analysis be performed.

Preferred Alternative: No Action Alternative

This alternative utilizes estimated air emissions data from total site operations at Hanford assuming continuation of site missions as described in Section 3.2. These data reflect conservative estimates of criteria and toxic/hazardous emissions at Hanford. The emission rates for the criteria and toxic/hazardous pollutants for No Action are presented in Table F.1.2.2–1. Table 4.2.1.3–1 presents the No Action concentrations. Increased PM₁₀ and TSP concentrations may occur due to ongoing construction associated with other activities (that are outside of the scope of the PEIS) under the No Action Alternative. Concentrations of all other criteria and toxic/hazardous air pollutants at the site boundary or public access highways are expected to remain within applicable Federal, State, and local ambient air quality standards.

Upgrade Alternative

Upgrade Without Rocky Flats Environmental Technology Site or Los Alamos National Laboratory Plutonium Subalternative

Modify Existing Fuels and Materials Examination Facility for Plutonium Storage

It is expected that pollutant concentrations will remain within applicable Federal and State ambient air quality standards during modification of the FMEF.

During operation, concentrations of criteria and toxic/hazardous air pollutants are predicted to be in compliance with Federal, State, and local air quality regulations or guidelines. Estimated pollutant concentrations attributable to increased operations associated with this storage alternative, plus the No Action concentrations, are presented in Table 4.2.1.3–1. Concentrations of air pollutants are expected to be the same with or without the RFETS or LANL material.

Construct New 200 West Area Facility for Plutonium Storage

In addition to the types of sources of emissions during construction associated with the No Action Alternative and the storage upgrade alternatives, fugitive dust resulting from the operation of a concrete batch plant would be an additional emission source associated with construction of a new facility.

Increased PM₁₀ and TSP concentrations may occur during the peak construction period, and during dry and windy conditions. Appropriate control measures would be followed to minimize pollutant concentrations during construction. Concentrations of all pollutants at the site boundary or public access highways would remain within applicable Federal and State ambient air quality standards during construction.

During operation, concentrations of criteria and toxic/hazardous air pollutants are predicted to be in compliance with Federal, State, and local air quality regulations or guidelines. Estimated pollutant concentrations attributable to increased operations associated with this storage alternative, plus the No Action concentrations, are presented in Table 4.2.1.3–1. Concentrations of air pollutants are expected to be similar with or without the RFETS or LANL material since pollutant emissions are the result of combustion of fossil fuels for heating the facility.

Upgrade With All or Some Rocky Flats Environmental Technology Site and Los Alamos National Laboratory Plutonium Subalternative

Modify Existing Fuels and Materials Examination Facility for Plutonium Storage

Air quality impacts for construction and operation for this option are expected to be similar to those previously described for modifying the FMEF.

Construct New 200 West Area Facility for Plutonium Storage

Air quality impacts for construction and operation for this option are expected to be similar to those previously described for the new Pu storage facility.

Consolidation Alternative

Construct New Plutonium Storage Facility

Air quality impacts for construction and operation for this option are expected to be similar to those for the options previously discussed for the Upgrade Alternative.

Collocation Alternative

Construct New Plutonium and Highly Enriched Uranium Storage Facilities

The collocation of Pu and HEU materials facilities would be located in the same area as the consolidated Pu materials facilities and would have similar air quality impacts, with the following exceptions.

During operation, emissions would be slightly higher, as shown in Appendix F. Concentrations of criteria and toxic/hazardous air pollutants are predicted to be in compliance with Federal, State, and local air quality regulations or guidelines. Estimated pollutant concentrations attributable to increased operations associated with this storage alternative and No Action are presented in Table 4.2.1.3–1.

Subalternative Not Including Strategic Reserve and Weapons Research and Development Materials

Air quality impacts for construction and operation for this subalternative are expected to be similar to those previously described for the Upgrade With All or Some RFETS and LANL Pu Subalternative, the Consolidation Alternative, and the Collocation Alternative. Since the same facility or a slightly smaller facility would be constructed or upgraded, the construction activities would be expected to have the same or less emissions. Storage of a smaller quantity of material would be expected to result in less emissions during operation of the facility as a result of reduced combustion emissions, laboratory operations, and other activities. [Text deleted.]

Phaseout

Phaseout of existing Pu inventories as a result of consolidating Pu at another site is expected to result in a small reduction in air pollutant concentrations from the No Action concentrations and would be in compliance with Federal and State standards. Some emissions may occur as a result of transporting materials from Hanford. Quantity of emissions is dependent on transportation mode.

NOISE

The location of the storage facilities relative to the site boundary and sensitive receptors was examined to evaluate the potential for onsite and offsite noise impacts. Noise sources during construction may include heavy construction equipment and increased traffic. Increased traffic would occur onsite and along offsite local and regional transportation routes used to bring construction material and workers to the site.

Preferred Alternative: No Action Alternative

Nontraffic noise sources associated with continued interim storage (No Action) and other ongoing missions are the same as described in Chapter 3. The continuation of operations at Hanford would result in no appreciable change in traffic noise and onsite operational noise sources from current levels. Nontraffic noise sources are

located at sufficient distance from offsite areas that the contribution to offsite noise levels would continue to be small. Due to the size of the site, noise emissions from construction equipment and operations activities would not be expected to cause annoyance to the public. Some noise sources may be located close enough to onsite noise sensitive areas to result in impacts, such as disturbances of wildlife.

Upgrade, Consolidation, and Collocation Alternatives

Nontraffic noise sources associated with the storage alternatives would be similar to those for existing facilities as discussed in Chapter 3. Nontraffic, operational noise sources associated with the alternatives include new or existing equipment and machines (cooling systems, vents, motors, and material handling equipment). These noise sources would be located at sufficient distance from offsite areas that the contribution to offsite noise levels would be small. Due to the size of the site, noise emissions from construction equipment and operations activities would not be expected to cause annoyance to the public. Some noise sources may result in impacts, such as disturbance of wildlife.

Subalternative Not Including Strategic Reserve and Weapons Research and Development Materials

Noise impacts for construction and operations for this option are expected to be almost the same to those previously described for the Upgrade With All or Some RFETS and LANL Pu Subalternative, the Consolidation Alternative, and the Collocation Alternative because noise impacts are based on the use of the facility and not the size. [Text deleted.]

Phaseout

A reduction in noise levels associated with facility operations may result from the phaseout of storage facilities.

4.2.1.4 Water Resources

Construction and operation of the potential long-term storage facilities at Hanford would affect water resources. All facility options (in either the 400 or 200 Areas) are above the 100-year, 500-year, probable maximum flood (40,000 m³/s [1.4 million ft³/s]), flooding from dam failures, and flooding from a landslide resulting in river blockage. At Hanford, surface water resources, primarily the Columbia River, would be used to meet all construction and operation water requirements for facilities located in the vicinity of the 200 Area. The Columbia River has sufficient flow to support any of the alternatives. No construction- or operation-related impacts would exceed 1.1 percent of the Columbia River's average flow. Groundwater would be used to meet water requirements for facilities located in the 400 Area. During construction and operation of the facilities, treated wastewater would continue to be discharged in compliance with NPDES permit requirements, to infiltration ponds in the 200 Area, or nearby streams, or would be recycled at newly constructed wastewater treatment facilities. Stormwater runoff would be collected and treated, if necessary, before discharge to natural drainage channels in accordance with permit requirements. [Text deleted.]

Minimal impacts to groundwater are anticipated because no direct discharges would occur during construction and operation. Table 4.2.1.4-1 presents No Action water resources uses and discharges and the potential changes to water resources at Hanford resulting from the long-term storage alternatives.

Preferred Alternative: No Action Alternative

Surface Water. [Text deleted.] A description of the activities that would continue at Hanford is provided in Section 3.2. Under this alternative, surface water withdrawals from the Columbia River are not expected to increase from the current usage of 13,511 million l/yr (3,569 million gal/yr) by 2005. Treated wastewater discharged to infiltration/evaporation ponds is expected to remain at 246 million l/yr (65 million gal/yr). Under this alternative, current restoration programs would continue, and water quality is anticipated to improve.

Groundwater. Under this alternative, no additional impacts to groundwater resources are anticipated. Withdrawals from current operations in the 400 Area (195 million l/yr [51.6 million gal/yr]) are not anticipated to increase by 2005.

Upgrade Alternative

Upgrade Without Rocky Flats Environmental Technology Site Plutonium or Los Alamos National Laboratory Plutonium Subalternative

Modify Existing Fuels and Materials Examination Facility for Plutonium Storage

Surface Water. There are no unique construction characteristics associated with water requirements and discharges from the modify FMEF option. Since the facilities are located in the 400 Area, no surface water would be withdrawn for any modification or operation activities. Groundwater from the unconfined aquifer would be used to meet water requirements. Since upgrades will take place in an existing facility, no impact to surface water would result from soil erosion of disturbed land and siltation of surface drainage channels during modifications. During operation, stormwater runoff would be collected and treated, if necessary, before discharge to natural drainage channels.

During modification of selected areas of the FMEF, sanitary wastewater (approximately 3.9 million l/yr [1.0 million gal/yr]) would be generated and discharged to the existing wastewater treatment systems at the 400 Area. This would cause a 1.6-percent increase in the effluent discharged at Hanford. During operation, wastewater would be discharged to infiltration/evaporation ponds. [Text deleted.]

Fire sprinkler water and truck hose-down water would be collected in tanks, monitored for radioactivity, and if uncontaminated, discharged to storm drains that discharge to local drainage channels. If contaminated, this water would be treated as required.

The FMEF is located in the 400 Area above the floodplain from the probable maximum flood of 40,000 m³/s (1.4 million ft³/s), which is greater than the 500-year flood. The possibility of flooding from dam failures with a flood wave of 600,000 m³/s (21 million ft³/s) has been studied by the COE. In addition to the areas inundated by the probable maximum flood, the remainder of the 100 Area, the 300 Area, and nearly all of Richland, but not the 400 Area, would be flooded. A landslide resulting in river blockage downstream of the 400 Area, and flooding along the Columbia River during a river flood flow of 17,000 m³/s (600,000 ft³/s), would not inundate the FMEF. Additionally, it is unlikely that the landslide would be downstream.

Groundwater. During modification activities, the quantity of water required would be approximately 5.0 million l/yr (1.3 million gal/yr), which would represent a 2.6-percent increase over the projected No Action groundwater withdrawal (195 million l/yr [52 million gal/yr]). During operation, groundwater would be obtained from existing supply systems in the 400 Area. The total annual requirement for the modified FMEF would be 8.4 million l/yr (2.2 million gal/yr), which would represent a 4.3-percent increase over the projected groundwater withdrawal (195 million l/yr [52 million gal/yr]). It is not expected that these small increases would impact regional groundwater levels.

No wastewater would be discharged directly to groundwater, so groundwater quality would not be affected. However, some of the treated wastewater discharged to evaporation/percolation ponds would percolate downward into the groundwater. The water discharged to and from the ponds would be monitored and would not be discharged until contaminant levels were within the limits specified. Impacts to groundwater quality are therefore not expected. In addition, other factors contributing to a lessening of potential impacts to groundwater are the combined effects of a deep water table, low discharge volumes, and high evaporation rates.

Similarly, some stormwater runoff and other discharges routed to storm drains could percolate into the subsurface. Storm sewer and storm drain discharges would be monitored under the NPDES stormwater regulations. No impacts to groundwater quality are expected.

Construct New 200 West Area Facility for Plutonium Storage

Surface Water. Because the new Hanford Pu storage facility would be located in the 200 West Area, surface water would be used to meet water requirements. During construction, approximately 5 million l/yr (1.3 million gal/yr) of water would be required. This represents a much less than 1-percent increase in the projected No Action surface water withdrawal. This additional withdrawal would not cause any impacts. During operation, approximately 8.4 million l/yr (2.2 million gal/yr) of water would be required. This represents a much less than 1-percent increase in the projected annual surface water withdrawal, and it would increase Hanford's total withdrawal from the Columbia River to less than 1.0×10^{-6} of the river's average minimum flow. This would not cause any impacts to surface water availability.

During construction of the new Hanford Pu storage facility, sanitary wastewater (approximately 3.9 million l/yr [1.0 million gal/yr]) would be generated and discharged to the existing wastewater treatment systems at the 200 West Area. This would cause a 1.6-percent increase in the effluent discharged at Hanford. During operation, treated wastewater would be discharged to evaporation/infiltration ponds. [Text deleted.] All discharges would be monitored to comply with discharge requirements. Makeup water for the closed-cycle cooling system would be recycled.

The new facility would be located in the 200 Area, which is above the 100-year, 500-year, probable maximum floods, flooding from dam failures, and flooding from a landslide resulting from river blockage.

Groundwater. Because surface water would be used during construction and operation, no impact on groundwater availability is anticipated. No wastewater would be discharged from the ponds directly to groundwater, so groundwater quality would not be affected. However, some of the treated wastewater discharged to evaporation/percolation ponds could percolate downward into the groundwater. The water would be monitored and would not be discharged until contaminant levels were within the limits specified in the NPDES permit. Impacts to groundwater quality are therefore not expected. In addition, other factors contributing to a lessening of potential impacts to groundwater are the combined effects of a deep water table, low discharge volumes, and high evaporation rates. Similarly, some stormwater runoff routed to storm drains could percolate into the subsurface. These discharges would be monitored under the NPDES stormwater regulations. No impacts to groundwater quality are expected.

Upgrade With All or Some Rocky Flats Environmental Technology Site Plutonium and Los Alamos National Laboratory Plutonium Subalternative

Modify Existing Fuels and Materials Examination Facility for Plutonium Storage

Modification activities would require 7.8 million l/yr (2.1 million gal/yr) of water, a 4.0-percent increase over the projected No Action water use. This is approximately 2.8 million l/yr (0.74 million gal/yr) of water more than that required for the Pu storage upgrade without RFETS Pu or LANL Pu material water requirements. During operations, 8.9 million l/yr (2.4 million gal/yr) of water would be required, a 4.6-percent increase over projected No Action water use. All other water requirements of the Pu storage upgrade with RFETS Pu and LANL Pu material are identical to the modified FMEF without RFETS Pu or LANL material.

Modifying FMEF to store RFETS Pu and LANL Pu material would increase water discharges by 5.9 million l/yr (1.6 million gal/yr) or 1.9 percent during construction activities over the projected No Action discharge. During operations, wastewater would be discharged to infiltration/evaporation ponds. All other wastewater requirements of the upgrade with RFETS Pu and LANL Pu material are similar to the modified FMEF without RFETS Pu or LANL Pu material.

Construct New 200 West Area Facility for Plutonium Storage

During construction, the facility would require 7.8 million l/yr (2.1 million gal/yr), a much less than 1-percent increase over projected No Action water use. All other water requirements of the new Pu storage upgrade with RFETS Pu and LANL Pu material are identical to the new Hanford Pu facility without RFETS Pu or LANL Pu material. During operations, 8.9 million l/yr (2.4 million gal/yr) of water would be required. This represents a less than 1-percent increase in surface water withdrawal.

Water resources impacts during construction and operation with RFETS Pu and LANL Pu material would increase water discharges by 5.9 million l/yr (1.6 million gal/yr) or 1.9 percent of the projected No Action discharge. During operations, wastewater would be discharged to infiltration/evaporation ponds. All other wastewater discharges of the upgrade with RFETS Pu and LANL Pu material are the same as previously discussed for the new Hanford Pu storage facility without RFETS Pu or LANL Pu material.

Consolidation Alternative

Construct New Plutonium Storage Facility

The new consolidated Pu storage facility would be located west of the 200 East Area of Hanford. Impacts associated with it are the same as those discussed above for the upgrade of the existing Pu storage area, with the following exceptions. The water requirements for construction and operation of this option are approximately 85 million l/yr (22.5 million gal/yr) and 110 million l/yr (29 million gal/yr), respectively. These additional requirements represent 0.6- and 0.8-percent increases, respectively, in the projected annual surface water withdrawals from the Columbia River and should not cause any impacts.

The quantity of sanitary wastewater generated during construction of this option would be approximately 7.7 million l/yr (2 million gal/yr). This represents a 3.1-percent increase in the projected annual wastewater effluent that would be discharged to evaporation/infiltration ponds. During operations, sanitary, utility, and process wastewaters would be recycled. No impacts to groundwater are expected from discharges. Groundwater would not be used for this alternative, so no impacts to groundwater availability or quality would be expected.

Collocation Alternative

Construct New Plutonium and Highly Enriched Uranium Storage Facilities

These storage facilities would be located west of the 200 East Area of Hanford, and the impacts associated with them are the same as those discussed above, with the following exceptions. The water requirements for construction and operation of this option are greater, approximately 105 million l/yr (27.7 million gal/yr) and 150 million l/yr (39.6 million gal/yr), respectively. These additional requirements represent 0.8- and 1.1-percent increases, respectively, in the projected annual surface water withdrawals from the Columbia River and should not cause any impacts.

The quantity of sanitary wastewater generated during construction of this option would be approximately 12.5 million l/yr (3.3 million gal/yr). This represents a 5.1-percent increase in the projected annual wastewater effluent that would be discharged to evaporation/infiltration ponds. During operations, sanitary, utility, and process wastewater would be recycled at newly constructed wastewater treatment systems. No impacts are expected. Groundwater would not be used for this alternative. Therefore, no impacts to groundwater availability or quality would be expected.

Subalternative Not Including Strategic Reserve and Weapons Research and Development Materials

Water resource impacts for construction and operation of this subalternative are expected to be slightly less than those for the Upgrade With All or Some RFETS Pu and LANL Pu, the Pu Consolidated, and the Pu and HEU Collocation Storage Alternatives at Hanford described previously because of the reduction in the amount of material. [Text deleted.]

Phaseout

Should the current Pu storage mission at Hanford be phased out, surface water withdrawals from the Columbia River and nonhazardous wastewater discharge to evaporation/percolation ponds would decrease by negligible quantities. No noticeable impacts would occur or be alleviated due to these decreases.

[Text deleted.]

4.2.1.5 Geology and Soils

Construction and operation of the alternatives at Hanford would have no effect on the geologic resources. A low seismic risk exists, but would be considered in the design of the proposed alternatives. The existing seismic risk does not preclude the safe construction and operation of the proposed alternative facilities. The facilities would be designed for earthquake-generated ground accelerations in accordance with DOE O 420.1, *Facility Safety*. Intensities of approximately V to VII on the MMI scale are possible in the general region. This could affect the integrity of poorly designed or nonreinforced structures, but should not affect newly designed facilities. Human health effects from accidents initiated by natural phenomenon (for example, earthquakes) are discussed in Section 4.2.1.9. A volcanic event of the Mt. St. Helens type could occur in the Cascade Mountain region to the west, resulting in a possible ashfall at Hanford. A recurrence of a similar event would not have an effect on the construction and operation of any of the proposed storage alternatives. It is highly unlikely that landslides, sinkhole development, or other nontectonic events would affect project activities. Slopes and underlying foundation materials are generally considered stable. Geologic resources at Hanford consist of crushed rock, sand, and gravel that have low economic value. New construction may increase the use of these materials; however, because large volumes of these materials are present, the impact is anticipated to be negligible.

Impacts to the geologic and soil resource occur during, or as a result of, ground-disturbing construction activities. Construction of the alternatives may involve ground disturbing activities that could affect the soil resources. The amount of land disturbed is specified below for each alternative. Impacts would depend on the specific soil units in the disturbed area, the extent of land disturbing activities, and the amount of soil disturbed. Control measures would be employed during construction activities to minimize soil erosion. [Text deleted.]

[Text deleted.]

Preferred Alternative: No Action Alternative

Under the No Action Alternative, DOE would continue current and ongoing activities at Hanford. There would be no ground-disturbing activities beyond those associated with existing and future site improvements. Because neither new construction nor the associated ground disturbance for potential soil erosion would occur, the No Action Alternative would have no effect on the geologic or soil resources at the site.

Upgrade Alternative

Upgrade Without Rocky Flats Environmental Technology Site Plutonium or Los Alamos National Laboratory Plutonium Subalternative

Modify Existing Fuels and Materials Examination Facility for Plutonium Storage

No apparent direct or indirect effects on the geologic resources are anticipated because neither facility construction and operational activities nor site infrastructure improvements will limit access to potential geologic resources. Design of the facilities would preclude potential impacts by any potential hazardous geological conditions.

Construction activities will occur completely within FMEF protected area, using existing gravel areas for construction laydown. Modification of the existing FMEF for Pu storage may disturb as much as 6.3 ha (15.5 acres) from construction activities, which would affect the soil profile and lead to a possible increase in soil erosion as a result of stormwater runoff and wind action. Soil impacts during operation are expected to be minimal.

Construct New 200 West Area Facility for Plutonium Storage

No apparent direct or indirect effects on the geologic resource are anticipated because neither facility construction and operational activities nor site infrastructure improvements will limit access to potential geologic resources. Design of the facilities would preclude potential impacts by any potential hazardous geological conditions.

Construction activities will occur completely within PFP protected area and use existing gravel areas for construction laydown. Construction of the new Pu storage facility will involve ground-disturbing construction activities (approximately 10.5 ha [26 acres]) that will affect the soil profile and potentially cause a temporary increase in soil erosion. Construction activities (foundation preparation) and associated building construction laydown areas can expose the soil profile and lead to a possible increase in soil erosion as a result of wind and water action. Soil loss would depend on the frequency and severity of rain, wind velocities (increases in wind velocities and durations increase potential soil erosion), and the size, location, and duration of ground-disturbing activities.

Net soil disturbance during operations would be considerably less than during construction because areas temporarily used for construction laydown would be restored. Although stormwater runoff and wind action could occur during operation, they are anticipated to be minimal. [Text deleted.]

Upgrade With All or Some Rocky Flats Environmental Technology Site Plutonium and Los Alamos National Laboratory Plutonium Subalternative

Modify Existing Fuels and Materials Examination Facility for Plutonium Storage

The construction and operation land-use requirements to modify the FMEF are not affected by the inclusion of RFETS and LANL Pu material. Therefore, the impacts would be similar to those discussed for the modify FMEF without RFETS or LANL Pu material.

Construct New 200 West Area Facility for Plutonium Storage

The construction and operation land use requirements for the new Hanford Pu storage facility are not affected by the inclusion or exclusion of RFETS and LANL Pu material. Therefore, the impacts would be similar to those discussed for the new 200 West Area Pu storage facility without RFETS or LANL Pu material.

Consolidation Alternative

Construct New Plutonium Storage Facility

Construction of the new Pu storage facility will occur completely on previously undisturbed land as defined by Section 4.1.1 in a location west of the 200 East Area. Implementation of the Consolidation Alternative will involve ground-disturbing activities (58.5 ha [144 acres]) that will affect the soil profile and potentially cause a temporary increase in soil erosion. No apparent direct or indirect effects on the geologic resource are anticipated because neither facility construction and operational activities nor site infrastructure improvements will limit access to potential geologic resources. Analysis in this section is the same as that provided for the new 200 West Area Pu storage facility without RFETS or LANL Pu material.

Collocation Alternative

Construct New Plutonium and Highly Enriched Uranium Storage Facilities

Construction and operation effects on geologic and soil resources for the Collocation Alternative would be similar to those described for the Consolidation Alternative. However, additional soil impacts would be expected. Construction activities would occur completely on undisturbed land (west of the 200 East Area) as defined by Section 4.1.1 and involve approximately 89.5 ha (221 acres) of land disturbance for the new facilities, affecting the soil profile and leading to a possible temporary increase in erosion as a result of stormwater runoff and wind action. Soil impacts during operation are expected to be minimal.

No apparent direct or indirect effects on the geologic resource are anticipated, because neither facility construction and operational activities nor site infrastructure improvements will restrict access to potential geologic resources.

Subalternative Not Including Strategic Reserve and Weapons Research and Development Materials

Exclusion of strategic reserve and weapons R&D materials would give almost the same effects to the geologic and soil resources for the Pu Subalternative, the Consolidation Alternative, and the Collocation Alternative. By excluding these materials, the size of a facility would be similar, thus not changing the amount of land disturbed by construction activities. No effect to the geologic resource is anticipated as a result of this subalternative. [Text deleted.]

Phaseout

The phaseout of storage capacity would have no apparent effects on the geologic resources. However, phaseout could result in beneficial effects on the soils of the area. Hazardous, radioactive, and mixed waste sources would be eliminated from the area, thus decreasing the potential for future soil contamination.

[Text deleted.]

4.2.1.6 Biological Resources

Preferred Alternative: No Action Alternative

Under No Action, the Pu storage mission described in Section 2.2.1 would continue at Hanford. These activities would result in no appreciable change to current conditions of biological resources at Hanford as described in Section 3.2.6.

Upgrade Alternative

Upgrade Without Rocky Flats Environmental Technology Site Plutonium or Los Alamos National Laboratory Plutonium Subalternative

Modify Existing Fuels and Materials Examination Facility for Plutonium Storage

Modifying selected areas of the FMEF within the 400 Area at Hanford would cause minimal disturbance to biological resources. This is because all activities would involve existing structures and would take place within an area that is currently disturbed. Noise associated with modifying the FMEF could cause some temporary disturbance to wildlife, but this impact would be minimal because animals living adjacent to the current facility have already adapted to its presence. Water withdrawal would be through wells and would involve relatively minor volumes, so wetlands and aquatic resources would not be affected. Wastewater would be discharged to evaporation/infiltration ponds. Since the upgrade would take place within a developed area, impacts to threatened and endangered species would not be expected.

Construct New 200 West Area Facility for Plutonium Storage

A new Pu storage facility would be constructed within the protected area of the PFP in the 200 West Area of Hanford. Although new construction would be involved in this option, it will take place within an area of the 200 West Area that is currently disturbed. Impacts to biological resources would be expected to be minimal and similar to those described above for the modification of the FMEF.

Upgrade With All or Some Rocky Flats Environmental Technology Site Plutonium and Los Alamos National Laboratory Plutonium Subalternative

Modify Existing Fuels and Materials Examination Facility for Plutonium Storage

Upgrading with all or some RFETS and LANL materials would not be expected to change impacts to biological resources from those described above for the modification of the FMEF.

Construct New 200 West Area Facility for Plutonium Storage

Upgrading with all or some RFETS and LANL materials would not be expected to change impacts to biological resources from those described above for the new Pu storage facility.

Consolidation Alternative

Construct New Plutonium Storage Facility

Under this alternative, Pu would be consolidated in a new storage facility located adjacent to the 200 East Area. Impacts to terrestrial resources, wetlands, aquatic resources, and threatened and endangered species are discussed below.

Terrestrial Resources. Construction and operation of the consolidated Pu storage facility would disturb 58.5 ha (144 acres) of terrestrial habitat, or about 0.04 percent of Hanford. This includes areas on which plant facilities would be constructed, as well as areas revegetated following construction. Vegetation within the proposed location would be destroyed during land-clearing operations. The project site falls within the sagebrush/cheatgrass or Sandberg's bluegrass community. Sagebrush communities are well represented on Hanford, but they are relatively uncommon regionally because of widespread conversion of shrub-steppe habitats to agriculture. Disturbed areas are generally recolonized by cheatgrass, a nonnative species, at the expense of native plants.

Construction of the Pu storage facility would affect animal populations. Less mobile animals within the project area, such as reptiles and small mammals, would not be expected to survive. Construction activities and noise would cause larger mammals and birds in the construction and adjacent areas to move to similar habitat nearby. If the area to which they moved was below its carrying capacity, these animals would be expected to survive. However, if the area was already supporting the maximum number of individuals, the additional animals would compete for limited resources, which could lead to habitat degradation and eventual loss of the excess population. Nests and young animals living within the proposed location may not survive. The location would be surveyed as necessary for the nests of migrating birds prior to construction. Areas disturbed by construction, but not occupied by facility structures, would be of minimal value to wildlife because they would be maintained as landscaped areas.

Activities associated with facility operations, such as noise and human presence, could affect wildlife living immediately adjacent to the Pu storage facility. These disturbances may cause some species to move from the area. Disturbance to wildlife living adjacent to the facility would be minimized by preventing workers from entering undisturbed areas. Salt drift generated by mechanical draft cooling systems would be minimal, so impacts are not expected.

Wetlands. Construction and operation of the Pu storage facility would not affect wetlands since no wetlands exist near the proposed location. Due to the relatively small amount of water required during both construction and operation, existing intake structures would be used. It would not be necessary to disturb wetlands along the Columbia River. Construction- and operation-related discharges would be directed to evaporation ponds and, thus, would not impact wetlands. All wastewater discharges would be treated, as necessary, to meet NPDES permit requirements.

Aquatic Resources. Construction of a Pu storage facility at Hanford would not impact aquatic resources since there are no surface water bodies near the proposed location. Water requirements during both construction and operation would be met by existing site sources. Since new intake structures would not be required, direct disturbance of aquatic resources in the Columbia River would not occur. Water withdrawal during both construction and operation would represent a small percentage of the Columbia River's average flow and would have little effect on the flow of the river. Flow-related impacts to aquatic resources from impingement and entrainment impacts would be minimal and unlikely to affect fish populations in the Columbia River. In compliance with the *Anadromous Fish Conservation Act* (16 USC 757a et seq.), populations of anadromous fish species would be sustained, and their movement would be unobstructed by project construction and operation. All discharges would be to evaporation ponds, which would provide temporary aquatic habitat.

Threatened and Endangered Species. It is unlikely that federally listed threatened and endangered species would be affected by construction and operation of the Pu storage facility. However, this alternative would disturb 58.5 ha (144 acres) of sagebrush habitat. Sagebrush habitat is important nesting/breeding and foraging habitat for several State-listed and candidate species, such as the ferruginous hawk, loggerhead shrike, western burrowing owl, pygmy rabbit, western sage grouse, sage sparrow, and sage thrasher. Preactivity surveys would

be conducted as appropriate prior to construction to determine the presence of plant species or animal species in the area to be disturbed. Consultation with the USFWS and State agencies would be conducted at the site-specific level, as appropriate.

Collocation Alternative

Construct New Plutonium and Highly Enriched Uranium Storage Facilities

Under this alternative, Pu would be stored with HEU inventories in a new collocated storage facility located in the 200 East Area. Construction and operation of collocated storage facilities at Hanford would have similar, but somewhat greater, effects on biological resources as those described for the consolidated storage facility alone. Construction of the collocated storage alternative would disturb 89.5 ha (221 acres) of habitat.

Subalternative Not Including Strategic Reserve and Weapons Research and Development Materials

The exclusion of strategic reserve and weapons R&D materials would have almost the same effects to the Upgrade With All or Some RFETS and LANL Pu Subalternative, the Consolidation Alternative, and the Collocation Alternative. The size of facility would be similar and would not result in the reduction of disturbed habitat and fewer facility modifications and the potential impacts to biological resources would be similar. [Text deleted.]

Phaseout

The phaseout of Pu storage facilities at Hanford is not expected to affect biological resources, although increased human activity could temporarily disturb some wildlife species in the vicinity of the site.

4.2.1.7 Cultural and Paleontological Resources

Preferred Alternative: No Action Alternative

Under this alternative, DOE would continue the existing and planned missions at Hanford, which include continued storage of Pu material in the PFP in stabilized forms pursuant to DNFSB Recommendation 94-1. All inventory and evaluation of cultural resources at Hanford is conducted within the framework of the *Hanford Cultural Resources Management Plan* (PNL-6942 UC-600, June 1989), which has been in place since 1989. Any impacts to cultural or paleontological resources from these missions would be independent of the proposed action and would be addressed through separate NHPA, *American Indian Religious Freedom Act*, and *Native American Graves Protection and Repatriation Act* regulatory compliance procedures.

Upgrade Alternative

Upgrade Without Rocky Flats Environmental Technology Site Plutonium or Los Alamos National Laboratory Plutonium Subalternative

Modify Existing Fuels and Materials Examination Facility for Plutonium Storage

The FMEF is located in the 400 Area of Hanford in an existing protected area. This option involves only modification to selected areas of the existing facility. No new construction would be necessary. Because it was recently built, the FMEF itself is not NRHP eligible. The 400 Area has been surveyed, and no archaeological or historic resources were identified. Consequently, any land-disturbing activity associated with building modification (such as equipment staging areas and temporary roads) should not affect cultural resources. Similarly, operation does not involve increased activity or ground disturbance, so it would not result in impact.

Construct New 200 West Area Facility for Plutonium Storage

The new Pu storage facility would be constructed in the 200 West Area northwest of the PFP facility within the existing protected area. The total land required during construction and operation is 10.5 ha (26 acres). All land was previously disturbed, and there will be no construction on undisturbed land.

[Text deleted.]

A non-systematic archaeological survey was conducted across 50 percent of the 200 West Area. No prehistoric or historic resources were identified, except for the White Bluffs Freight Road, which was used during both prehistoric and historic times. This portion of the road is a noncontributing element of the NRHP-listed resource, and has been given a buffer zone to protect it from development. The road is outside the proposed construction area and will not be affected. Depending on siting, construction, and operation, the new facility may affect the functional and historic setting of the PFP, which is an NRHP-eligible property. The PFP was constructed between 1947 and 1949 and was used to produce Pu metal during the Cold War Era. Some scientifically valuable Pliocene and Pleistocene paleontological deposits may also exist in the areas to be excavated during construction; although this is unlikely as previous construction activities did not reveal these kinds of resources. Archaeological and paleontological resources would not be affected by facility operation because operation does not involve additional ground disturbance or increased activity.

To date, no Native American groups have identified any areas of special concern in proximity to the 200 Areas. [Text deleted.] Operation may result in reduced access to traditional hunting, fishing, and gathering areas, or visual and auditory intrusion into sacred spaces.

Upgrade With All or Some Rocky Flats Environmental Technology Site Plutonium and Los Alamos National Laboratory Plutonium Subalternative

Modify Existing Fuels and Materials Examination Facility for Plutonium Storage

The inclusion of RFETS and LANL material would not increase the total area requirement of the Upgrade Without RFETS or LANL Subalternative, therefore, no ground-breaking construction would be necessary. All materials could be accommodated within existing facilities. Consequently, construction and operation are not expected to affect cultural or paleontological resources.

Construct New 200 West Area Facility for Plutonium Storage

Total land disturbed by construction and operation would not increase with the inclusion of RFETS and LANL materials. Construction of a slightly larger Pu storage facility is not expected to have more of an effect on cultural or paleontological resources, as discussed under the new Pu storage facility option.

Consolidation Alternative

Construct New Plutonium Storage Facility

This alternative would involve the construction of a new facility west of the 200 East Area. During construction, 58.5 ha (144 acres) would be disturbed. The total land required for operation is 56 ha (138 acres). A 1.6-km (1 mi) reduced-access buffer zone exists and would be maintained around the facility. Pu storage in existing DOE storage facilities would be phased out.

The 200 areas have been surveyed, and no prehistoric or historic resources were identified. The area is previously disturbed. Some significant paleontological materials may occur within this acreage. The potential for impacts to paleontological resources is greatest during construction. Operation would not have an additional impact on resources, should any be identified during construction. As discussed under the new Hanford Pu storage facility upgrade option, Native American groups have not identified any resources in proximity to the 200 Areas. Additional consultation may be necessary for resource identification.

Collocation Alternative

Construct New Plutonium and Highly Enriched Uranium Storage Facilities

This alternative would involve the construction of a new HEU storage facility to be collocated with a consolidated special nuclear material plant adjacent to the 200 East Area. Land required during operation would be 87 ha (215 acres). Construction of this facility is expected to disturb 89.5 ha (221 acres). A 1.6-km (1-mi) reduced-access buffer zone exists and would be maintained around the facility. Pu and HEU storage in existing facilities would be phased out. Potential for impacts to these resources would be similar to that discussed under the previous Consolidation Alternative.

Subalternative Not Including Strategic Reserve and Weapons Research and Development Materials

Under this subalternative, facility and other resource requirements will be almost the same as the Upgrade With All or Some RFETS Pu and LANL Pu Subalternative, the Consolidation Alternative, and the Collocation Alternative. Therefore, impacts to cultural and paleontological resources would be equal to those previously discussed. [Text deleted.]

Phaseout

Impacts to archaeological resources are not anticipated because phaseout is not expected to result in ground-breaking activity. Likewise, no impacts to paleontological remains are expected. It may affect, through alteration, if subsequently proposed, some NRHP-eligible historic structures at Hanford. Impacts to Native American resources are not expected.

| [Text deleted.]

4.2.1.8 Socioeconomics

Preferred Alternative: No Action Alternative

Under this alternative, the existing storage facility would remain operational. No new employment or in-migration of workers would be required.

Regional Economy Characteristics. Total employment in the REA is projected to increase by about 1.3 percent annually between 1995 and 2000, reaching 322,000 in the latter year. Long-range projections indicate slower growth after the year 2000, when employment will increase by less than 1 percent annually and reach 446,300 in 2040. Unemployment in the REA was 9.1 percent in 1994 and is expected to remain at this level into the near future. Per capita income is projected to increase from approximately \$18,996 in 1995 to \$28,079 in 2040. Projections for the No Action Alternative are presented in Table L.1–10.

Population and Housing. Population in the ROI is projected to increase from approximately 384,700 in 1995 to 568,600 by 2040. The total number of housing units in the ROI is projected to increase from approximately 140,900 to 208,200 during the same period. Population and housing projections for the No Action Alternative are presented in Tables L.1–11 and L.1–12, respectively.

Community Services. Education, public safety, and health care characteristics are used to assess the level of community services in the Hanford ROI. School enrollments are projected to increase from 76,891 students in 1995 to 113,659 students by 2040. To maintain the current student-to-teacher ratio of 18.9:1, the number of teachers in the ROI would need to increase from 4,077 in 1995 to 6,023 in 2040. These projections are presented in Tables L.1–13 and L.1–14, respectively.

The projected numbers of sworn police officers and firefighters serving in ROI communities over the period 1995 to 2000 are shown in Tables L.1–15 and L.1–16, respectively. Under No Action, the number of sworn police officers is projected to increase from 503 in 1995 to 742 in 2040 to maintain the current service level of 1.6 officers per 1,000 persons. The number of firefighters in the ROI would need to increase from 1,544 in 1995 to 2,281 in 2040 to maintain the current level of service of 4.0 firefighters per 1,000 persons.

Hospital occupancy rates are based on current capacity. Hospital occupancy rates and the estimated number of practicing physicians serving the ROI population between 1995 and 2040 are presented in Tables L.1–17 and L.1–18, respectively. Hospital occupancy rates for the ROI are projected to increase from 51 percent in 1995 to 75 percent in 2040. To maintain the current physician-to-population ratio of 1.2 physicians per 1,000 persons, the total number of physicians in the ROI would need to increase from 472 in 1995 to 696 in 2040.

Local Transportation. The worker population at Hanford would not increase. Therefore, any increases in traffic or air traffic would be due to the projected growth in the area unrelated to DOE activities. [Text deleted.]

Upgrade Alternative

Upgrade Without Rocky Flats Environmental Technology Site Plutonium or Los Alamos National Laboratory Plutonium Subalternative

Modify Existing Fuels and Materials Examination Facility for Plutonium Storage

[Text deleted.] A total of 54 workers would be employed during peak construction of the modified facility. During the operational phase, 225 workers would be required. Projections indicate that there would be sufficient available labor in the REA to fill both direct and indirect jobs generated as a result of construction and all indirect jobs generated by operation of the modified facility. Some workers would in-migrate to fill a portion of the direct jobs generated during operations.

Regional Economy Characteristics. During peak construction, the project would add up to 108 (54 direct and 54 indirect) jobs to the regional economy. All of these new jobs would be filled by available labor force in the REA and unemployment would fall from the No Action level of 9.1 percent to 9.0 percent (Socio 1996a). Per capita income would remain virtually unchanged, increasing by much less than 1 percent over the No Action Alternative.

Operation of the facility without storage of RFETS or LANL material would generate a total of 759 jobs (225 direct and 534 indirect) in the REA. These additional jobs would reduce regional unemployment by much less than 1 percent from the No Action level. Per capita income would increase by much less than 1 percent in the year 2005, when the facility would become fully operational (Socio 1996a).

Population, Housing, and Community Services. During construction, all newly created jobs would be filled by the resident labor force. Therefore, there would be no change to the region's population, housing market, or demand for community services beyond the No Action projections. A small increase in population would occur during operation of the facility due to the in-migration of five workers. Accordingly, there would be an insignificant effect on the housing market and the demand for community services (Socio 1996a).

Local Transportation. During the peak construction period, 104 vehicle trips per day would be generated by workers involved in facility modification. This increase would not affect level of service on the road segments analyzed. During operations, the workers would generate 432 vehicles trips per day. This increase over the No Action level would not affect the level of service on the local road segments analyzed (Socio 1996a).

Construct New 200 West Area Facility for Plutonium Storage

Work force requirements for the construction and operation of the new Pu storage facility are the same as for modification of the FMEF. Therefore, the magnitude of socioeconomic impacts for this option would be the same as those discussed above for the FMEF.

Upgrade With All or Some Rocky Flats Environmental Technology Site Plutonium and Los Alamos National Laboratory Plutonium Subalternative

Modify Existing Fuels and Materials Examination Facility for Plutonium Storage

A peak of 77 workers would be employed to modify the facility to store all of the RFETS and LANL material. During the operational phase, 252 workers would be required. Projections indicate that there would be sufficient labor available in the REA to fill all direct and indirect jobs generated by construction and all indirect jobs generated by operation of the modified facility. Some workers would in-migrate to fill a portion of the direct jobs generated by operation.

Regional Economy Characteristics. During peak construction, the project would generate 154 jobs (77 direct and 77 indirect) in the regional economy. All of these new jobs would be filled by available labor within the REA. Unemployment would fall from the No Action level of 9.1 percent to 9.0 percent (Socio 1996a). Per capita income would remain virtually unchanged, increasing by much less than one percent over the No Action Alternative.

Operation of the facility would generate a total of 850 (252 direct and 598 indirect) jobs. Regional unemployment would be reduced slightly from the No Action projection of 9.1 percent to 8.9 percent. Per capita income would increase by much less than 1 percent (Socio 1996a).

Population, Housing, and Community Services. All jobs generated by construction would be filled by the resident labor force. Therefore, there would be no change to the region's population from the No Action projections. Accordingly, there would be minimal effects on the housing market or demand for community

services. A small increase in population would occur during operation of the facility due to the in-migration of eight workers. Such an increase would have an insignificant effect on the housing market and the demand for community services (Socio 1996a).

If only a portion of the RFETS or LANL materials were transferred to Hanford, between 225 and 252 workers would be required to operate the facility. The exact number of workers would depend on the amount of material that would actually reside at Hanford. The size of the construction workforce would be between 54 and 77 workers in the peak year of construction. Between 108 and 154 jobs (direct and indirect) would be generated during construction while between 759 and 850 jobs (direct and indirect) would be generated during operations. There would be no changes to the ROI population over the No Action projections during construction, but could be some in-migration during operations. In all cases, the socioeconomic impacts to the region would be slight.

Local Transportation. During the peak construction period, 148 vehicle trips per day would be generated by workers involved in facility modification. During operations, workers would generate 484 vehicle trips per day. These increases would not affect the level of service on the local road segments analyzed. (Socio 1996a).

Construct New 200 West Area Facility for Plutonium Storage

Workforce requirements for the construction and operation of the new Pu storage facility are the same as for the modification of the FMEF. Therefore, the magnitude of socioeconomic impacts for this option would be the same as those discussed above for the FMEF.

Consolidation Alternative

Construct New Plutonium Storage Facility

To consolidate storage of Pu that is currently stored at multiple DOE sites, a new storage facility would need to be constructed at Hanford. A few workers would in-migrate to fill a portion of the direct jobs created during the operation of the new facility.

Regional Economy Characteristics. Construction would involve over 1,000 workers on site and add a total of 2,129 jobs (1,064 direct and 1,065 indirect) to the REA during the peak period of activity, an increase of less than 1 percent over the No Action level. All of these jobs would be filled by available labor in the REA. Unemployment would drop from 9.1 percent to about 8.5 percent. Per capita income would increase by much less than 1 percent in the peak year of construction (Socio 1996a).

The operation of the facility would add a total of 1,495 jobs (443 direct and 1,052 indirect) to the regional economy, an increase of less than 1 percent over the No Action level. A small percentage of the direct workers would in-migrate to fill some specialized employment requirements. Operation workers would begin phasing in as construction nears completion. Unemployment would rise from 8.5 percent during peak construction to 8.7 percent during operation, but would remain lower than the No Action level of 9.1 percent. Per capita income would increase by much less than 1 percent over No Action (Socio 1996a).

Population, Housing, and Community Services. A small increase in population would occur during the operation phase due to the in-migration of 27 workers. Such an increase would have no effect on the housing sector and would have an insignificant effect on the demand for community services (Socio 1996a).

Local Transportation. During the peak construction period, workers would generate 2,043 vehicle trips per day. This increase would not affect the level of service on the local road segments analyzed. During operations, workers would generate 851 vehicles trips per day, and the increase to roadway traffic would be less than during construction (Socio 1996a).

Collocation Alternative

Construct New Plutonium and Highly Enriched Uranium Storage Facilities

Construction of new storage facilities would be required in order to store Pu and HEU at Hanford. Workers would in-migrate to fill some of the direct jobs created during operation of the new storage facility. Construction employment would reach 1,076 during the peak period of activity. Operations would require 572 workers.

Regional Economy Characteristics. Construction of the new facility would generate a total of 2,153 jobs (1,076 direct and 1,077 indirect) during the peak construction year. The resident available labor force would be sufficient to fill all of the direct and indirect jobs created during the construction phase. Total employment in the REA would increase by less than 1 percent. Unemployment would decrease from 9.1 percent to 8.5 percent. Per capita income would increase by much less than 1 percent in the peak construction year (Socio 1996a).

Operation of the facility would produce a total of over 1,930 new jobs (572 direct and 1,358 indirect) within the REA. A majority of direct jobs and all of the indirect jobs generated would be filled by the resident labor force. Total employment in the REA would increase by less than 1 percent in the year 2005, when the facility would become fully operational. Operation workers would begin phasing in as construction nears completion. Unemployment would rise from 8.5 percent during peak construction to 8.6 percent during operation, but would remain lower than the No Action level of 9.1 percent. Per capita income is projected to increase by less than 1 percent (Socio 1996a).

Population and Housing. A small number of workers are projected to in-migrate during the operation period. The population increase would be negligible, and projected housing vacancies would be sufficient to accommodate the incremental population increase (Socio 1996a).

Community Services. The additional population would slightly increase demand for some community services. Worker in-migration would lead to an increase in ROI school enrollment by approximately 35 students during operation. In order to maintain the No Action student-to-teacher ratio, the number of teachers would have to increase by one (Socio 1996a). [Text deleted.]

In order to maintain the No Action level of service, two firefighters would need to be hired during the operational period. No additional police would be required to maintain the No Action level of service during the operational period (Socio 1996a).

The small population change would have a negligible effect on health services, increasing hospital occupancy by much less than 1 percent. The number of physicians in the ROI would be sufficient to maintain the No Action level of service.

Local Transportation. During the peak construction period, workers would generate 2,066 vehicle trips per day. This increase would not affect the level of service on the road segments analyzed. During operations, workers would generate 1,098 vehicles trips per day and the increase in roadway traffic would be less than during construction (Socio 1996a).

Subalternative Not Including Strategic Reserve and Weapons Research and Development Materials

If strategic reserve and weapons R&D materials are not included in the storage requirements for Hanford, there would be a small reduction in worker requirements for construction and operation of the facility due to fewer workers being needed. Therefore, the socioeconomic effects would be less than under those alternatives that include storage of nonsurplus RFETS and LANL material for the Upgrade With All or Some RFETS and LANL Pu Subalternative, the Consolidation Alternative, and the Collocation Alternative. [Text deleted.]

Phaseout

Phaseout of the existing Pu storage facility at Hanford would result in the loss of 675 total jobs (200 direct and 475 indirect) in the REA. The total direct and indirect employment loss would be much less than a 1 percent reduction in the projected regional employment levels for the year 2005, when the phaseout would be implemented.

In the longer term, some unemployed workers may migrate out of the REA to seek new employment opportunities. Even if all of these workers were to leave the REA with their families, population would decrease by much less than 1 percent compared to No Action. The impact on housing and community services, including health care, education, and public safety would not be substantial. For example, there could be a slight increase in housing vacancies or a decline in new housing construction and also a small decrease in demand for educational and health services (for example, teachers and physicians). These minor impacts would be further reduced if the storage mission is phased out over more than 1 year.

Phaseout of the existing Pu storage facilities at Hanford would reduce the number of vehicle trips per day by 384. There would be no significant traffic impact to the local road network.

4.2.1.9 Public and Occupational Health and Safety

The assessments of potential radiological and chemical impacts associated with the storage alternatives at Hanford are presented in this section. Summaries of radiological impacts from normal operations are presented in Tables 4.2.1.9–1 and 4.2.1.9–2 for the public and workers, respectively. Impacts from hazardous chemicals are presented in Table 4.2.1.9–3. Summaries of impacts associated with postulated accidents are given in Tables 4.2.1.9–4 through 4.2.1.9–7. Detailed results are presented in Appendix M.

Preferred Alternative: No Action Alternative

This section describes the radiological and hazardous chemical releases and their associated impacts resulting from normal operations involving the Hanford sitewide missions, including interim storage of Pu. The impacts would be within applicable regulatory limits. For facility accidents, the risks and consequences are described in site safety documentation.

Normal Operation. The current mission at Hanford, where Pu is in interim storage, is described in Section 3.2. The site has identified those facilities that will continue to operate under the No Action Alternative, including interim Pu storage facilities and others, if any, that will become operational by 2005. Based on that information, the radiological and chemical releases to the environment in 2005 and beyond (future operation) were developed and used in the impact assessments. The resulting doses and potential health effects on the public and workers at Hanford are described below.

Under the No Action Alternative, Hanford would continue to store Pu-bearing materials in the storage vaults and approved vault-type rooms of the PFP. All Pu materials would be stabilized and repackaged, as necessary, to ensure safe storage. Activities supporting stabilization, repackaging, and storage of the Pu materials are identified and discussed in the *DNFSB Recommendation 94-1 Hanford Site Integrated Stabilization Management Plan* (VHC-EP-0853). This plan calls for transforming the Pu-bearing materials to a stable form that meets the DOE standard *Criteria for Safe Storage of Pu Metals and Oxides* (DOE-STD-3013-94) by 2002 for materials with greater than 50 percent Pu. Some PFP plant systems that are required to provide basic facility services would be upgraded for storage facility operations for the No Action Alternative.

Radiological Impacts. Under this alternative at Hanford, Table 4.2.1.9–1 presents the calculated annual dose to the average and MEI of the public, from total site operation, the projected fatal cancer risks to these individuals from 50 years of operation, the dose to the population within 80 km (50 mi) due to total site operation in the year 2030, and the projected number of fatal cancers in this population from 50 years of operation. The annual dose of 5.3×10^{-3} mrem to the MEI is within the radiological limits specified in NESHAPS (40 CFR 61, Subpart H) and DOE Order 5400.5. From 50 years of operation, the corresponding risk of fatal cancer to this individual would be 1.3×10^{-7} . The annual dose of 1.6 person-rem to the population of 621,000 would be within the limit in proposed 10 CFR 834. The corresponding number of fatal cancers in this population from 50 years of operation would be 0.039. To put operational doses into perspective, comparisons with natural background radiation doses are included in the table. The doses and projected fatal cancers associated with the storage component of the No Action Alternative are included in Table 4.2.1.9–1. These are seen to be much lower than those from total site operations.

Under the No Action Alternative shown in Table 4.2.1.9–2, the annual average dose to a noninvolved (No Action) site worker and the annual dose to the noninvolved (No Action) total site workforce would be 31 mrem and 296 person-rem, respectively. The associated risk of fatal cancer to the average worker from 50 years of total site operations would be 6.0×10^{-4} and the projected number of fatal cancers from 50 years of total site operations would be 5.1.

The annual average dose to a worker involved in No Action storage operations would be 250 mrem/year, with a total involved No Action workforce dose of 49 person-rem. The increased risk of latent cancer fatality to the

Table 4.2.1.9–3. Potential Hazardous Chemical Impacts to the Public and Workers During Normal Operation at Hanford Site—No Action and Storage Alternatives

Receptor	No Action	Upgrade		Consolidation		Collocation	
	Total Site ^a	Facility ^b	Total Site ^a	Facility ^b	Total Site ^a	Facility ^b	Total Site ^a
Maximally Exposed Individual (Public)							
Hazard Index ^c	6.2x10 ⁻⁵	9.4x10 ⁻⁷	6.3x10 ⁻⁵	4.0x10 ⁻⁶	6.6x10 ⁻⁵	1.6x10 ⁻⁵	7.8x10 ⁻⁵
Cancer risk ^d	0	0	0	2.7x10 ⁻⁸	2.7x10 ⁻⁸	2.7x10 ⁻⁸	2.7x10 ⁻⁸
Worker Onsite							
Hazard Index ^e	4.0x10 ⁻³	1.9x10 ⁻⁵	4.0x10 ⁻³	2.8x10 ⁻⁴	4.3x10 ⁻³	7.1x10 ⁻⁴	4.7x10 ⁻³
Cancer risk ^f	0	0	0	1.2x10 ⁻⁵	1.2x10 ⁻⁵	1.2x10 ⁻⁵	1.2x10 ⁻⁵

^a Total=Sum of the No Action plus the contributions of the above activity.

^b Facility=Contribution from the above activity only (for example, the amount of increase over the existing, No Action level at the site).

^c Hazard index for MEI=Sum of Individual Hazard Quotients (Noncancerous health effects) for MEI.

^d Cancer risk for MEI=(Emissions for 8-hr) x (0.286 [Converts concentrations to doses]) x (Slope Factor [SF]).

^e Hazard index for workers=Sum of Individual Hazard Quotients (Noncancerous health effects) for workers.

^f Cancer risk for workers=(Emissions for 8-hr) x (0.286 [Converts concentrations to doses]) x (0.237 [Fraction of year exposed]) x (0.571 [Fraction of lifetime working]) x (SF).

Note: Where there are no known carcinogens among the hazardous chemicals emitted, there are no slope factors, therefore the calculated risk value is 0.

Source: Section M.3, Tables M.3.4–1 through M.3.4–4.

average No Action worker from 50 years of operation would be 5.0x10⁻³, and the projected number of latent fatal cancers to the No Action workforce from 50 years of operation would be 0.92.

Hazardous Chemical Impacts. Hazardous chemical impacts to the public resulting from the normal operation under No Action at Hanford are presented in Table 4.2.1.9–3. The hazardous chemical impacts from current site operations represent the baseline site impacts for the various storage alternatives. The noncancerous health effects and the risk of cancer due to the total chemical exposures were estimated. Since the major releases due to normal operation at Hanford are expected to make up nearly all of the exposures to onsite workers and to the public in adjacent communities, contributions to the hazardous chemical concentrations from all other sources (for example, industrial operations) are considered negligible for purposes of risk calculations.

The HI to the MEI of the public at Hanford resulting from normal operation under the No Action Alternative is 6.2x10⁻⁵, and the cancer risk from hazardous chemicals is zero (because no carcinogens are released from the hazardous chemicals used). The HI to the onsite worker is 4.0x10⁻³, and the cancer risk is zero (because no carcinogens are released from the hazardous chemicals used).

Facility Accidents. Under the No Action Alternative, Pu would continue to be stored at Hanford in existing facilities. These facilities currently operate in accordance with DOE Orders which ensure that the risk to the public of prompt fatalities due to accidents or cancer fatalities due to operations will be minimized. The safety to workers and the public from accidents at existing facilities is also controlled by Technical Safety Requirements specified in detail in a Safety Analysis Report (SAR) or a Basis for Interim Operations document prepared and maintained specifically for a facility or process within a facility. Under these controls, any change in approved operations or to facilities would cause a halt in operations until it can be established that worker and public safety has not been compromised.

The *Plutonium Finishing Plant Safety Analysis Report* (WHC-SD-CP-SAR-021) analyzes a wide spectrum of accidents that are primarily associated with processing rather than vault storage. This is because a release from a vault would require more severe accident conditions than are normally analyzed in an SAR. The accidents in

the SAR consist of potential process accidents such as fires, explosions, and criticality as well as an externally initiated aircraft crash and earthquake. An estimate of the effects of potential accidents in the existing storage vault at Hanford can be derived from similar storage accidents that have been postulated for an upgraded storage facility. A severe consequence, low frequency accident for storage under the No Action Alternative would be a beyond design basis earthquake. If this accident were to occur, there would be an estimated 0.12 latent cancer fatalities in the offsite population within 80 km (50 mi). The estimated frequency of the earthquake with sufficient damage to cause a release is approximately 1.0×10^{-7} per year, which corresponds to a risk of 1.2×10^{-8} latent cancer fatalities per year. For the MEI and noninvolved worker, there would be 1.7×10^{-5} and 2.2×10^{-3} latent cancer fatalities, respectively, if the accident occurred. The risks would be 1.7×10^{-12} and 2.2×10^{-10} latent cancer fatalities per year. A potentially more frequent accident is penetration of the PCV caused by corrosion. If this accident were to occur, the estimated number of cancer fatalities in the offsite population would be 1.3×10^{-3} . The estimated frequency of this accident is 6.4×10^{-3} per year, which corresponds to a risk of 8.3×10^{-5} cancer fatalities per year. For the MEI and noninvolved worker the corresponding impacts are 1.8×10^{-7} and 1.8×10^{-5} latent cancer fatalities, respectively, if the accident occurred. The risks would be 1.2×10^{-9} and 1.2×10^{-7} latent cancer fatalities per year.

Upgrade Alternative

This section describes the radiological and hazardous chemical releases and their associated impacts resulting either from normal operation or from accidents involved with the modified FMEF or a new storage facility at Hanford. The section describes the impacts from normal facility operations at Hanford, followed by a description of impacts from facility accidents.

During normal operation at Hanford, the operation of any of these Pu storage facilities would result in impacts that are within applicable regulatory limits.

[Text deleted.]

Upgrade Without Rocky Flats Environmental Technology Site Plutonium or Los Alamos National Laboratory Plutonium Subalternative

Modify Existing Fuels and Materials Examination Facility for Plutonium Storage

Normal Operation. There would be no radiological releases during the modification of the FMEF at Hanford. Construction worker exposures to material potentially contaminated with radioactivity (for example, from construction activities involved with existing contaminated soil) would be limited to assure that doses are maintained as low as reasonably achievable (ALARA). Toward this end, construction workers would be monitored as appropriate. Limited hazardous chemical releases are anticipated as a result of the construction activities. However, concentrations would be within the regulated exposure limits. During normal operation, there would be radiological and hazardous chemical releases to the environment as well as direct exposures. The resulting doses and potential health effects on the public and workers at Hanford are described below.

Radiological Impacts. Doses to the public from storage would be expected to decrease from No Action for the Upgrade Alternative, as shown in Table 4.2.1.9–1. This is because the storage facility safety and design features would improve. The dose to the MEI of the public due to annual storage facility operation would be 1.8×10^{-6} mrem. From 50 years of operation, the corresponding risk of fatal cancer to this individual would be 4.5×10^{-11} . The impacts to the average individual would be less. As a result of storage facility operation in the year 2030, the population dose would be 4.7×10^{-5} person-rem. The corresponding number of fatal cancers in this population due to 50 years of operation would be 1.2×10^{-6} .

The dose to the MEI due to annual total site operations is within the radiological limits specified in NESHAPS (40 CFR 61, Subpart H) and DOE Order 5400.5, and would be 5.1×10^{-3} mrem. From 50 years of operations, the

corresponding risk of fatal cancer to this individual would be 1.3×10^{-7} . These values are presented in Table 4.2.1.9–1. The impacts to the average individual would be less. This activity would be included in a program to ensure that doses to the public are ALARA. As a result of total site operations in the year 2030, the population dose would be within the limit in proposed 10 CFR 834 and would be 1.5 person-rem. The corresponding number of fatal cancers in this population from 50 years of operation would be 0.038.

Doses to onsite workers from normal operations are given in Table 4.2.1.9–2. Included are involved workers directly associated with the modified facility for Pu storage, workers who are not involved with the modified facility, and the entire workforce at Hanford. All doses fall within regulatory limits and administrative control levels. The associated risks and numbers of fatal cancers among the different workers from 50 years of operation are included in the table. Dose to individual workers would be kept low by instituting badged monitoring and ALARA programs and also workers rotations. As a result of the implementation of these mitigation measures, the actual number of fatal cancers calculated would be lower for the operation of this facility

Hazardous Chemical Impacts. Hazardous chemical impacts to the public and to the onsite worker resulting from the normal operations of the upgraded storage facilities at Hanford are presented in Table 4.2.1.9–3. The impacts from all site operations, including the upgraded storage facilities are also included in this table. Total site impacts, which include the No Action impact plus the facility are provided. All analyses to support the values presented in this table are provided in Section M.3.

The HI from the facility to the MEI of the public is 9.4×10^{-7} , and the cancer risk from hazardous chemicals from the facility is zero (because no carcinogens are released from the hazardous chemicals used) as a result of operation of the upgraded storage facilities in the year 2030. The HI and cancer risk would remain constant over 50 years of operation, because exposures would be expected to remain the same. The total site operation, including the upgrade facility, would result in an HI of 6.3×10^{-5} and a cancer risk of zero (because no carcinogens are released) for the MEI in the year 2030. This would be expected to remain constant as a result of 50 years of operation.

The HI from the facility to the onsite worker would be 1.9×10^{-5} and the cancer risk from the facility is zero (because no carcinogens are released from the hazardous chemicals used) as a result of operation of the upgraded storage facilities in the year 2030. The HI and cancer risk would remain constant over 50 years of operation, provided exposures remain the same. The total site operation including the upgrade facility would result in an HI of 4.0×10^{-3} and a cancer risk of zero (because no carcinogens are released) for the worker in the year 2030. This would be expected to remain constant as a result of 50 years of operation.

Facility Accidents. Modification of the existing Pu storage facilities at the Hanford site may change the existing risks of accidents to workers and the public. Under this action, the FMEF would be modified and would be in compliance with applicable DOE Orders and other regulations and standards. This may result in a reduction of risk compared to No Action.

A set of potential accidents have been postulated for upgraded storage at FMEF of existing Pu without LANL or RFETS Pu for which there may be releases of Pu that may impact onsite workers and the offsite population. The accident consequences and risks to a worker located 1,000 m (3,280 ft) from the accident release point, the maximum offsite individual located at the site boundary, and the population located within 80 km (50 mi) of the accident release point are summarized in Table 4.2.1.9–4. For the set of accidents analyzed, the maximum number of cancer fatalities in the population within 80 km (50 mi) would be 0.12 at Hanford for the beyond design basis earthquake accident scenario with an estimated probability of 1.0×10^{-7} per year (for example, probability of severe earthquake occurring is estimated to be about 1.0×10^{-5} , once in 100,000 years, multiplied by a damage and release probability of 0.01). The corresponding 50-year facility lifetime risk from the same accident scenario for the population, maximum offsite individual, and worker at 1,000 m (3,280 ft), would be 6.1×10^{-7} , 8.3×10^{-11} , and 1.1×10^{-8} , respectively. The maximum population 50-year facility lifetime risk would

be 4.2×10^{-4} (for example, one fatality in over 100,000 years) at Hanford for the PCV penetration by corrosion accident scenario with a probability of 6.4×10^{-3} per year. The corresponding maximum offsite individual and worker 50-year facility lifetime risks would be 5.7×10^{-8} and 5.7×10^{-6} , respectively. Section M.5 presents additional facility accident data and summary descriptions of the accident scenarios identified in Table 4.2.1.9–4.

Involved workers, those that would work in the facilities associated with the proposed action, may be subject to injury and, in some cases, fatality as a result of potential accidents. The locations of workstations, number of workers, personnel protective features, engineered safety features, and other design details affect the extent of worker exposures to accidents. Certain accidents such as fires, explosions, and criticality could cause fatalities to workers close to the accident. Prior to construction of a new or modification of an existing facility, DOE Orders require detailed safety analyses to assure that facility designs and operating procedures limit the number of workers in hazardous areas and minimize risk of injury or fatality in the event of an accident.

Construct New 200 West Area Facility for Plutonium Storage

Normal Operation. There would be no radiological releases during the construction of new storage facilities at Hanford. Construction worker exposures to material potentially contaminated with radioactivity (for example, from construction activities involved with existing contaminated soil) would be limited to assure that doses are maintained ALARA. Toward this end, construction workers would be monitored as appropriate. Limited hazardous chemical releases are anticipated as a result of the construction activities. However, concentrations would be within the regulated exposure limits. During normal operation, there would be radiological and hazardous chemical releases to the environment as well as direct exposures. The resulting doses and potential health effects to the public and workers at Hanford are described below.

Radiological Impacts. The doses and associated health risks to the public associated with this new storage facility are expected to be even smaller than those for the modified FMEF. Total site doses and resulting health risks would be virtually the same for both storage facilities. The doses and associated health risks to workers are assumed to be the same as for the modified FMEF (Table 4.2.1.9–2). This is because the operations would be similar and the amount of material handled would be the same.

Hazardous Chemical Impacts. Hazardous chemical emissions from the new Pu storage facility would be less than the emissions from the modified FMEF. The resultant health risks to the public and workers from hazardous chemical emissions associated with this new storage facility would be even smaller than those given in Table 4.2.1.9–3 for the modified FMEF.

Facility Accidents. A new Pu storage facility for continued storage of Pu would incorporate new safety features that should reduce the consequences and risks of accidents compared with No Action. The consequences and risks of accidents for this new facility would be bounded by the consequences and risks presented in Table 4.2.1.9–4 for the upgraded FMEF at Hanford.

Involved workers, those that would work in the facilities associated with the proposed action, may be subject to injury and, in some cases, fatality as a result of potential accidents. The locations of workstations, number of workers, personnel protective features, engineered safety features, and other design details affect the extent of worker exposures to accidents. Certain accidents such as fires, explosions, and criticality could cause fatalities to workers close to the accident. Prior to construction of a new or modification of an existing facility, DOE Orders require detailed safety analyses to assure that facility designs and operating procedures limit the number of workers in hazardous areas and minimize risk of injury or fatality in the event of an accident.

Table 4.2.1.9–4. Upgrade Without Rocky Flats Environmental Technology Site or Los Alamos National Laboratory Material Alternative—Accident Impacts at Hanford Site

Accident Description	Worker at 1,000 m		Maximum Offsite Individual		Population to 80 km		Accident Frequency (per yr)
	Risk of Cancer Fatality (per 50 yr) ^a	Probability of Cancer Fatality ^b	Risk of Cancer Fatality (per 50 yr) ^a	Probability of Cancer Fatality ^b	Risk of Cancer Fatalities (per 50 yr) ^a	Number of Cancer Fatalities ^c	
PCV puncture by forklift	1.3×10^{-7}	4.4×10^{-6}	1.3×10^{-9}	4.4×10^{-8}	9.6×10^{-6}	3.2×10^{-4}	6.0×10^{-4}
PCV breach by firearms discharge	7.7×10^{-9}	4.4×10^{-7}	7.7×10^{-11}	4.4×10^{-9}	5.6×10^{-7}	3.2×10^{-5}	3.5×10^{-4}
PCV penetration by corrosion	5.7×10^{-6}	1.8×10^{-5}	5.7×10^{-8}	1.8×10^{-7}	4.2×10^{-4}	1.3×10^{-3}	6.4×10^{-3}
Vault fire	5.8×10^{-9}	1.2×10^{-3}	4.6×10^{-11}	9.2×10^{-6}	3.4×10^{-7}	0.067	1.0×10^{-7}
Truck bay fire	3.1×10^{-9}	6.1×10^{-4}	3.1×10^{-11}	6.1×10^{-6}	2.2×10^{-7}	0.045	1.0×10^{-7}
Spontaneous combustion	3.1×10^{-11}	8.8×10^{-7}	3.1×10^{-13}	8.8×10^{-9}	2.2×10^{-9}	6.4×10^{-5}	7.0×10^{-7}
Explosion in the vault	7.2×10^{-10}	1.4×10^{-4}	7.2×10^{-12}	1.4×10^{-6}	5.3×10^{-8}	0.011	1.0×10^{-7}
Explosion outside of vault	3.3×10^{-11}	6.6×10^{-6}	3.3×10^{-13}	6.6×10^{-8}	2.4×10^{-9}	4.8×10^{-4}	1.0×10^{-7}
Nuclear criticality	2.1×10^{-11}	4.2×10^{-6}	1.6×10^{-13}	3.3×10^{-8}	1.8×10^{-10}	3.5×10^{-5}	1.0×10^{-7}
Beyond design basis earthquake	1.1×10^{-8}	2.2×10^{-3}	8.3×10^{-11}	1.7×10^{-5}	6.1×10^{-7}	0.12	1.0×10^{-7}
Expected risk ^d	5.8×10^{-6}	–	5.8×10^{-8}	–	4.3×10^{-4}	–	–

^a The risk values are calculated by multiplying the probability of cancer fatality (for the worker at 1,000 m or the maximum offsite individual) or the number of cancer fatalities (for the population to 80 km) by the accident frequency and the number of years in operation.

^b Increased likelihood (or probability) of cancer fatality to a hypothetical individual (a single onsite worker at a distance of 1,000 m or the site boundary, whichever is smaller or to a hypothetical individual in the offsite population located at the site boundary) if exposed to the indicated dose. The value assumes the accident has occurred.

^c Estimated number of cancer fatalities in the entire offsite population out to a distance of 80 km if exposed to the indicated dose. The value assumes the accident has occurred.

^d Expected risk is the sum of the risks for each accident over the 50-year lifetime of the facility.

Note: All values are mean values.

Source: Calculated using Table 4.2.1.9–6 data adjusted for existing inventory of Pu at Hanford.

Upgrade With All or Some Rocky Flats Environmental Technology Site Plutonium and Los Alamos National Laboratory Plutonium Subalternative

Modify Existing Fuels and Materials Examination Facility for Plutonium Storage

Normal Operation. As described for the Upgrade Without RFETS or LANL Pu, there would be no radiological releases during the modification of the FMEF at Hanford. Construction worker exposures to material potentially contaminated with radioactivity would be limited to assure that doses are maintained ALARA. Toward this end, construction workers would be monitored as appropriate. Limited hazardous chemical releases are anticipated as a result of the construction activities. However, concentrations would be within the regulated exposure limits. During normal operation, there would be radiological and hazardous chemical releases to the environment as well as direct exposures. The resulting doses and potential health effects on the public and workers at Hanford are described below.

Radiological Impacts. During normal operations, there would be only a negligible difference in radiological impacts if Pu from the RFETS and LANL is included in the upgrade storage alternative. Therefore, the impacts are essentially the same as presented in the previous section, which discusses the upgrade without RFETS or LANL Pu.

Hazardous Chemical Impacts. Hazardous chemicals associated with storage of Pu from RFETS and LANL does not measurably contribute to hazardous chemical emissions from the facility for this subalternative. Therefore resultant hazardous chemical impacts to the public and worker are essentially the same as presented in the previous section, which discusses the upgrade without RFETS or LANL Pu.

Facility Accidents. Upgrade of the existing Pu storage facilities at the Hanford site may change the existing risks of accidents to workers and the public. Under upgrade, all Pu storage facilities would be brought into compliance with applicable DOE Orders and other regulations and standards. This may result in a reduction of risk compared to No Action.

A set of potential accidents have been postulated for the RFETS and LANL Pu storage increment for which there may be releases of Pu that may impact onsite workers and the offsite population. The accident consequences and risks to a worker located 1,000 m (3,280 ft) from the accident release point, the maximum offsite individual located at the site boundary, and the population located within 80 km (50 mi) of the accident release point are summarized in Table 4.2.1.9–5. For the set of accidents analyzed, the maximum number of cancer fatalities in the population within 80 km (50 mi) would be 0.12 at Hanford for the beyond design basis earthquake accident scenario with an estimated probability of 1.0×10^{-7} per year (for example, probability of severe earthquake occurring is estimated to be about 1.0×10^{-5} , once in 100,000 years, multiplied by a damage and release probability of 0.01). The corresponding 50-year facility lifetime risk from the same accident scenario for the population, maximum offsite individual, and worker at 1,000 m (3,280 ft), would be 6.2×10^{-7} , 8.5×10^{-11} , and 1.1×10^{-8} , respectively. The maximum population 50-year facility lifetime risk would be 4.3×10^{-4} (for example, on fatality in over 100,000 years) at Hanford for the PCV penetration by corrosion accident scenario with a probability of 6.6×10^{-3} per year. The corresponding maximum offsite individual and worker 50-year facility lifetime risks would be 5.9×10^{-8} and 5.9×10^{-6} , respectively. Table 4.2.1.9–5 also shows the Combined Expected Risk for the upgraded storage of existing Pu, the RFETS Pu and the LANL Pu increment. Section M.5 presents additional facility accident data and summary descriptions of the accident scenarios identified in Table 4.2.1.9–5.

Involved workers, those that would work in the facilities associated with the proposed action, may be subject to injury and, in some cases, fatality as a result of potential accidents. The locations of workstations, number of workers, personnel protective features, engineered safety features, and other design details affect the extent of worker exposures to accidents. Certain accidents such as fires, explosions, and criticality could cause fatalities to workers close to the accident. Prior to construction of a new or modification of an existing facility, DOE Orders require detailed safety analyses to assure that facility designs and operating procedures limit the number of workers in hazardous areas and minimize risk of injury or fatality in the event of an accident.

Construct New 200 West Area Facility for Plutonium Storage

Normal Operation. As described for the Upgrade Without RFETS or LANL Pu, there would be no radiological releases during the construction of the new 200 West Area Facility. Construction worker exposures to material potentially contaminated with radioactivity (for example, from construction activities involved with existing contaminated soil) would be limited to assure that doses are maintained ALARA. Toward this end, construction workers would be monitored as appropriate. Limited hazardous chemical releases are anticipated as a result of the construction activities. However, concentrations would be within the regulated exposure limits. During normal operation, there would be radiological and hazardous chemical releases to the environment as well as direct exposures. The resulting doses and potential health effects to the public and workers at Hanford are described below.

Radiological Impacts. During normal operations, there would be only a negligible difference in radiological impacts if Pu from the RFETS and LANL is included in the upgrade storage alternative. Therefore, the impacts are essentially the same as presented in the previous section, which discusses the Upgrade Without RFETS or LANL Pu.

Table 4.2.1.9–5. Upgrade With Rocky Flats Environmental Technology Site and Los Alamos National Laboratory Material Alternative—Accident Impacts at Hanford Site

Accident Description	Worker at 1,000 m		Maximum Offsite Individual		Population to 80 km		Accident Frequency (per yr)
	Risk of Cancer Fatality (per 50 yr) ^a	Probability of Cancer Fatality ^b	Risk of Cancer Fatality (per 50 yr) ^a	Probability of Cancer Fatality ^b	Risk of Cancer Fatalities (per 50 yr) ^a	Number of Cancer Fatalities ^c	
PCV puncture by forklift	1.3×10^{-7}	4.4×10^{-6}	1.3×10^{-9}	4.4×10^{-8}	9.6×10^{-6}	3.2×10^{-4}	6.0×10^{-4}
PCV breach by firearms discharge	7.7×10^{-9}	4.4×10^{-7}	7.7×10^{-11}	4.4×10^{-9}	5.6×10^{-7}	3.2×10^{-5}	3.5×10^{-4}
PCV penetration by corrosion	5.9×10^{-6}	1.8×10^{-5}	5.9×10^{-8}	1.8×10^{-7}	4.3×10^{-4}	1.3×10^{-3}	6.6×10^{-3}
Vault fire	5.9×10^{-9}	1.2×10^{-3}	4.7×10^{-11}	9.4×10^{-6}	3.5×10^{-7}	0.069	1.0×10^{-7}
Truck bay fire	3.1×10^{-9}	6.1×10^{-4}	3.1×10^{-11}	6.1×10^{-6}	2.2×10^{-7}	0.045	1.0×10^{-7}
Spontaneous combustion	3.1×10^{-11}	8.8×10^{-7}	3.1×10^{-13}	8.8×10^{-9}	2.2×10^{-9}	6.4×10^{-5}	7.0×10^{-7}
Explosion in the vault	7.4×10^{-10}	1.4×10^{-4}	7.4×10^{-12}	1.4×10^{-6}	5.4×10^{-8}	0.011	1.0×10^{-7}
Explosion outside of vault	3.3×10^{-11}	6.6×10^{-6}	3.3×10^{-13}	6.6×10^{-8}	2.4×10^{-9}	4.8×10^{-4}	1.0×10^{-7}
Nuclear criticality	2.1×10^{-11}	4.2×10^{-6}	1.6×10^{-13}	3.3×10^{-8}	1.8×10^{-10}	3.5×10^{-5}	1.0×10^{-7}
Beyond evaluation basis earthquake	1.1×10^{-8}	2.3×10^{-3}	8.5×10^{-11}	1.7×10^{-5}	6.2×10^{-7}	0.12	1.0×10^{-7}
Expected risk ^d	6.0×10^{-6}	—	6.0×10^{-8}	—	4.3×10^{-4}	—	—
Combined expected risk ^e	1.2×10^{-5}	—	1.2×10^{-7}	—	8.6×10^{-4}	—	—

^a The risk values are calculated by multiplying the probability of cancer fatality (for the worker at 1,000 m or the maximum offsite individual) or the number of cancer fatalities (for the population to 80 km) by the accident frequency and the number of years in operation.

^b Increased likelihood (or probability) of cancer fatality to a hypothetical individual (a single onsite worker at a distance of 1,000 m or the site boundary, whichever is smaller or to a hypothetical individual in the offsite population located at the site boundary) if exposed to the indicated dose. The value assumes the accident has occurred.

^c Estimated number of cancer fatalities in the entire offsite population out to a distance of 80 km if exposed to the indicated dose. The value assumes the accident has occurred.

^d Expected risk is the incremental risk for storing the additional RFETS and LANL material for each accident over the 50-year lifetime of the facility.

^e Combined expected risk for base case without RFETS or LANL Pu material plus RFETS and LANL Pu material increment.

Note: All values are mean values.

Source: Calculated using in Tables 4.2.1.9–6. Data adjusted for additional RFETS and LANL Pu.

Hazardous Chemical Impacts. Hazardous chemicals associated with storage of Pu from RFETS and LANL associated with building a new Pu facility are essentially the same as presented in the previous section, which discusses the upgrade without RFETS or LANL Pu. The resultant hazardous chemical impacts to the public and worker are essentially the same as presented in the previous section.

Facility Accidents. The new 200 West Area Facility constructed for continued storage of Pu would incorporate new safety features that should reduce the consequences and risks of accidents compared with No Action. The consequences and risks of accidents for this facility would be bounded by the consequences and risks presented in Table 4.2.1.9–5 for the Modify Existing FMEF for Pu Storage Subalternative at Hanford.

Involved workers, those that would work in the facilities associated with the proposed action, may be subject to injury and, in some cases, fatality as a result of potential accidents. The locations of workstations, number of workers, personnel protective features, engineered safety features, and other design details affect the extent of worker exposures to accidents. Certain accidents such as fires, explosions, and criticality could cause fatalities to workers close to the accident. Prior to construction of a new or modification of an existing facility, DOE Orders require detailed safety analyses to assure that facility designs and operating procedures limit the number of workers in hazardous areas and minimize risk of injury or fatality in the event of an accident.

Consolidation Alternative

Construct New Plutonium Storage Facility

This section includes a description of radiological and hazardous chemical releases and their associated impacts resulting from either normal operation or accidents involving the new consolidated Pu storage facility at Hanford.

[Text deleted.]

Normal Operation. There would be no radiological releases during the construction of a new consolidated Pu storage facility at Hanford. Construction worker exposures to material potentially contaminated with radioactivity (for example, from construction activities involved with existing contaminated soil) would be limited to assure that doses are maintained ALARA. Toward this end, construction workers would be monitored as appropriate. Limited hazardous chemical releases are anticipated as a result of construction activities. However, concentrations would be within the regulated exposure limits. During normal operation, there would be radiological and hazardous chemical releases to the environment as well as direct in-plant exposures. The resulting doses and potential health effects to the public and workers at Hanford are described below.

Radiological Impacts. Radiological impacts to the public resulting from the normal operation of the new consolidated Pu storage facility are presented in Table 4.2.1.9–1. The impacts from all site operations, including the new consolidated Pu storage facility, are also given in the table. To put operational doses into perspective, comparisons of operational doses with natural background radiation doses are included in the table.

The dose to the MEI due to annual storage facility operation would be 2.5×10^{-6} mrem. From 50 years of operation, the corresponding risk of fatal cancer to this individual would be 6.2×10^{-11} . As a result of storage plant operation in the year 2030, the population dose would be 1.1×10^{-4} person-rem. The corresponding number of fatal cancers in this population due to 50 years of operation would be 2.8×10^{-6} .

The dose to the MEI due to annual total site operations is within the radiological limits specified in NESHAPS (40 CFR 61, Subpart H) and DOE Order 5400.5 and would be 5.1×10^{-3} mrem. From 50 years of operation, the corresponding risk of fatal cancer to this individual would be 1.3×10^{-7} . The impacts to the average individual would be less. This activity would be included in a program to ensure that doses to the public are ALARA. As a result of total site operation in the year 2030, the population dose would be within the limit in proposed 10 CFR 834 and would be 1.5 person-rem. The corresponding number of fatal cancers in this population due to 50 years of operation would be 0.038.

Doses to onsite workers from normal operations are given in Table 4.2.1.9–2. Included are involved workers directly associated with the new consolidated Pu storage facility, workers who are not involved with the new storage facility, and the entire workforce at Hanford. All doses fall within regulatory limits and administrative control levels. The associated risks and numbers of fatal cancers among the different workers from 50 years of operation are included in the table. Dose to individual workers would be kept low by instituting badged monitoring and ALARA programs and also workers rotations. As a result of the implementation of these mitigation measures, the actual number of fatal cancers calculated would be lower for the operation of this facility.

Hazardous Chemical Impacts. Hazardous chemical impacts to the public and to the onsite worker resulting from the normal operations of the new consolidated Pu storage facility at Hanford are presented in Table 4.2.1.9–3. The impacts from all site operations, including the consolidated storage facility, are included in this table. Total site impacts, which include the No Action impact plus the added facility impact, are provided. All analyses to support the values presented in this table are provided in Section M.3.

The HI to the MEI of the public is 4.0×10^{-6} , and the cancer risk is 2.7×10^{-8} as a result of operation of the new consolidated Pu storage facility in the year 2030. The HI and cancer risk would remain constant over 50 years of operation, provided exposures remain the same. The total site operation including the upgrade facility would result in an HI of 6.6×10^{-5} and a cancer risk of 2.7×10^{-8} for the MEI in the year 2030. This would be expected to remain constant as a result of 50 years of operation.

The HI to the onsite worker would be 2.8×10^{-4} , and the cancer risk is 1.2×10^{-5} as a result of operation of the new consolidated Pu storage facility in the year 2030. The HI and cancer risk would remain constant over 50 years of operation, provided exposures remain the same. The total site operation including the upgrade facility would result in an HI of 4.3×10^{-3} and a cancer risk of 1.2×10^{-5} for the MEI in the year 2030. This would be expected to remain constant as a result of 50 years of operation.

Facility Accidents. A set of potential accidents for the consolidation of Pu alternative at Hanford for which there may be releases of Pu that may impact onsite workers and the offsite population has been postulated. The accident consequences and risks to a worker located 1,000 m (3,280 feet) from the accident release point, the maximum offsite individual located at the site boundary, and the population located within 80 km (50 mi) of the accident release point are summarized in Table 4.2.1.9–6. For the set of accidents analyzed, the maximum number of cancer fatalities in the population within 80 km (50 mi) would be 1.2 at Hanford for the beyond design basis earthquake accident scenario with an estimated probability of 1.0×10^{-7} per year (that is, probability of severe earthquake occurring is estimated to be about 1.0×10^{-5} , once in 100,000 years, multiplied by a damage and release probability of 0.01). The corresponding 50-year facility lifetime risk from the same accident scenario for the population, maximum offsite individual, and worker at 1,000 m (3,280 ft), would be 6.1×10^{-6} , 8.3×10^{-10} , and 1.1×10^{-7} , respectively. The maximum population 50-year facility lifetime risk would be 4.2×10^{-3} (that is, one fatality in about 12,000 years) at Hanford for the PCV penetration by corrosion accident scenario with a probability of 0.064 per year. The corresponding maximum offsite individual and worker 50-year facility lifetime risks would be 5.7×10^{-7} and 5.7×10^{-5} , respectively. Section M.5 presents additional facility accident data and summary descriptions of the accident scenarios identified in Table 4.2.1.9–6.

Involved workers, those that would work in the facilities associated with the proposed action, may be subject to injury and, in some cases, fatality as a result of potential accidents. The locations of workstations, number of workers, personnel protective features, engineered safety features, and other design details affect the extent of worker exposures to accidents. Certain accidents such as fires, explosions, and criticality could cause fatalities to workers close to the accident. Prior to construction of a new or modification of an existing facility, DOE Orders require detailed safety analyses to assure that facility designs and operating procedures limit the number of workers in hazardous areas and minimize risk of injury or fatality in the event of an accident.

Collocation Alternative

Construct New Plutonium and Highly Enriched Uranium Storage Facilities

This section includes a description of radiological and hazardous chemical releases and the associated impacts resulting from either normal operation or accidents involved with the consolidation of Pu storage and collocation with HEU storage facilities at Hanford. This storage would take place in a new Pu and HEU storage facility.

Normal operation of the new collocated storage facility at Hanford would result in impacts that are within applicable regulatory limits.

[Text deleted.]

Normal Operation. There would be no radiological releases during the construction of a new collocated storage facility at Hanford. Construction worker exposures to materials potentially contaminated with radioactivity (for

Table 4.2.1.9–6. Consolidation Alternative Accident Impacts at Hanford Site

Accident Description	Worker at 1,000 m		Maximum Offsite Individual		Population to 80 km		Accident Frequency (per yr)
	Risk of Cancer Fatality (per 50 yr) ^a	Probability of Cancer Fatality ^b	Risk of Cancer Fatality (per 50 yr) ^a	Probability of Cancer Fatality ^b	Risk of Cancer Fatalities (per 50 yr) ^a	Number of Cancer Fatalities ^c	
PCV puncture by forklift	1.3×10^{-7}	4.4×10^{-6}	1.3×10^{-9}	4.4×10^{-8}	9.6×10^{-6}	3.2×10^{-4}	6.0×10^{-4}
PCV breach by firearms discharge	7.7×10^{-9}	4.4×10^{-7}	7.7×10^{-11}	4.4×10^{-9}	5.6×10^{-7}	3.2×10^{-5}	3.5×10^{-4}
PCV penetration by corrosion	5.7×10^{-5}	1.8×10^{-5}	5.7×10^{-7}	1.8×10^{-7}	4.2×10^{-3}	1.3×10^{-3}	0.064
Vault fire	5.8×10^{-8}	0.012	4.6×10^{-10}	9.2×10^{-5}	3.4×10^{-6}	0.67	1.0×10^{-7}
Truck bay fire	3.1×10^{-9}	6.1×10^{-4}	3.1×10^{-11}	6.1×10^{-6}	2.2×10^{-7}	0.045	1.0×10^{-7}
Spontaneous combustion	3.1×10^{-11}	8.8×10^{-7}	3.1×10^{-13}	8.8×10^{-9}	2.2×10^{-9}	6.4×10^{-5}	7.0×10^{-7}
Explosion in the vault	7.2×10^{-11}	1.4×10^{-3}	7.2×10^{-11}	1.4×10^{-5}	5.3×10^{-7}	0.11	1.0×10^{-7}
Explosion outside of vault	3.3×10^{-11}	6.6×10^{-6}	3.3×10^{-13}	6.6×10^{-8}	2.4×10^{-9}	4.8×10^{-4}	1.0×10^{-7}
Nuclear criticality	2.1×10^{-11}	4.2×10^{-6}	1.6×10^{-13}	3.3×10^{-8}	1.8×10^{-10}	3.5×10^{-5}	1.0×10^{-7}
Beyond evaluation basis earthquake	1.1×10^{-7}	2.2×10^{-2}	8.3×10^{-10}	1.7×10^{-4}	6.1×10^{-6}	1.2	1.0×10^{-7}
Expected risk ^d	5.8×10^{-5}	–	5.8×10^{-7}	–	4.3×10^{-3}	–	–

^a The risk values are calculated by multiplying the probability of cancer fatality (for the worker at 1,000 m or the maximum offsite individual) or the number of cancer fatalities (for the population to 80 km) by the accident frequency and the number of years of operation.

^b Increased likelihood (or probability) of cancer fatality to a hypothetical individual (a single onsite worker at a distance of 1,000 m or the site boundary, whichever is smaller or to a hypothetical individual in the offsite population located at the site boundary) if exposed to the indicated dose. The value assumes the accident has occurred.

^c Estimated number of cancer fatalities in the entire offsite population out to a distance of 80 km if exposed to the indicated dose. The value assumes the accident has occurred.

^d Expected risk is the sum of the risks for each accident over the 50-year lifetime of the facility.

Note: All values are mean values.

Source: Calculated using the source terms in Tables M.5.2.1.1–5 and M.5.2.1.1–6 and the MACCS computer code.

example, from construction activities involved with existing contaminated soil) would be limited to assure that doses are maintained ALARA. Toward this end, construction workers would be monitored as appropriate. Limited hazardous chemical releases are anticipated as a result of construction activities. However, concentrations would be within the regulated exposure limits. During normal operation, there would be radiological and hazardous chemical releases to the environment as well as direct in-plant exposures. The resulting doses and potential health effects to the public and workers are described below.

Radiological Impacts. Radiological impacts to the public resulting from the normal operation of the new collocated storage facility at Hanford are presented in Table 4.2.1.9–1. The impacts from all site operations, including the new storage facility, are also given in the table. To put operational doses into perspective, comparisons of operational doses with natural background radiation doses are included in the table.

The dose to the MEI of the public due to annual storage facility operation would be 2.5×10^{-6} mrem. From 50 years of operation, the corresponding risk of fatal cancer to this individual would be 6.2×10^{-11} . The impacts to the average individual would be less. As a result of storage facility operation in the year 2030, the population

dose would be 1.1×10^{-4} person-rem. The corresponding number of fatal cancers in this population due to 50 years of operation would be 2.8×10^{-6} .

The dose to the MEI of the public due to annual total site operations is within radiological limits and would be 5.1×10^{-3} mrem. From 50 years of operation, the corresponding risk of fatal cancer to this individual would be 1.3×10^{-7} . The impacts to the average individual would be less. This activity would be included in a program to ensure that doses to the public are ALARA. As a result of total site operation in the year 2030, the population dose would be within the limit in proposed 10 CFR 834 and would be 1.5 person-rem. The corresponding number of fatal cancers in this population due to 50 years of operation would be 0.038.

Doses to onsite workers due to normal operations are given in Table 4.2.1.9–2. Included are involved workers directly associated with the new storage facility, workers who are not involved with the new storage facility, and the entire workforce at Hanford. All doses fall within regulatory limits and administrative control levels. The associated risks and numbers of fatal cancers among the different workers from 50 years of operation are included in the table. Dose to individual workers would be kept low by instituting badged monitoring and ALARA programs and also worker rotations. As a result of the implementation of these mitigation measures, the actual number of fatal cancers calculated would be lower for the operation of this facility.

Hazardous Chemical Impacts. Hazardous chemical impacts to the public and to the onsite worker resulting from the normal operations of the new consolidation of Pu storage and collocation with HEU storage facilities at Hanford are presented in Table 4.2.1.9–3. The impacts from all site operations, including the consolidation of Pu storage and collocation with HEU storage facilities, are also included in this table. Total site impacts, which include the No Action impact plus the added facility impacts, are provided. All analyses to support the values presented in this table are provided in Section M.3.

The HI to the MEI of the public is 1.6×10^{-5} , and the cancer risk is 2.7×10^{-8} as a result of operation of the new consolidation of Pu storage and collocation with HEU storage facilities in the year 2030. The HI and cancer risk would remain constant over 50 years of operation, because exposures would be expected to remain the same. The total site operation, including the new facility, would result in an HI of 7.8×10^{-5} and a cancer risk of 2.7×10^{-8} for the MEI in the year 2030. This would be expected to remain constant as a result of 50 years of operation.

The HI to the onsite worker is 7.1×10^{-4} , and the cancer risk is 1.2×10^{-5} as a result of operation of the new consolidation of Pu storage and collocation with HEU storage facilities in the year 2030. The HI and cancer risk would remain constant over 50 years of operation, because exposures would be expected to remain the same. The total site operation including the new facility would result in an HI of 4.7×10^{-3} and a cancer risk of 1.2×10^{-5} for the onsite worker in the year 2030. This would be expected to remain constant as a result of 50 years of operation.

Facility Accidents. A set of potential accidents for collocation of Pu and HEU at Hanford for which there may be releases of Pu or HEU that may impact onsite workers and the offsite population has been postulated. The consequences and risks of potential accidents for Pu and HEU storage would be bounded by the impacts associated with the release of Pu. The accident consequences and risks to a worker located 1,000 m (3,280 feet) from the accident release point, the maximum offsite individual located at the site boundary, and the population located within 80 km (50 mi) of the accident release point are summarized in Table 4.2.1.9–7. For the set of accidents analyzed, the maximum number of cancer fatalities in the population within 80 km (50 mi) would be 1.2 at Hanford for the beyond design basis earthquake accident scenario with an estimated probability of 1.0×10^{-7} per year (that is, probability of severe earthquake occurring is estimated to be about 1.0×10^{-5} , once in 100,000 years, multiplied by a damage and release probability of 0.01). The corresponding 50-year facility lifetime risk from the same accident scenario for the population, maximum offsite individual, and worker at 1,000 m (3,280 ft), would be 6.1×10^{-6} , 8.3×10^{-10} , and 1.1×10^{-7} , respectively. The maximum population 50-year facility lifetime risk would be 4.2×10^{-3} (that is, one fatality in about 12,000 years) at Hanford for the PCV penetration by corrosion accident scenario with a probability of 0.064 per year. The corresponding maximum

offsite individual and worker 50-year facility lifetime risks would be 5.7×10^{-7} and 5.7×10^{-5} , respectively. Section M.5 presents additional facility accident data and summary descriptions of the accident scenarios identified in Table 4.2.1.9–7.

Involved workers, those that would work in the facilities associated with the proposed action, may be subject to injury and, in some cases, fatality as a result of potential accidents. The locations of workstations, number of workers, personnel protective features, engineered safety features, and other design details affect the extent of worker exposures to accidents. Certain accidents such as fires, explosions, and criticality could cause fatalities to workers close to the accident. Prior to construction of a new or modification of an existing facility, DOE Orders require detailed safety analyses to assure that facility designs and operating procedures limit the number of workers in hazardous areas and minimize risk of injury or fatality in the event of an accident.

Subalternative Not Including Strategic Reserve and Weapons Research and Development Materials

If the strategic reserve and weapons R&D materials are not included, the incremental impacts to the public and to workers from the accident-free storage activities would be reduced in proportion to the decrease in the amount of material stored. The impacts from total site operations would decrease slightly. This subalternative applies to the Upgrade With All or Some RFETS and LANL Pu Subalternative, the Consolidation Alternative, and the Collocation Alternative. The risks due to accidents would also tend to be lower.

Table 4.2.1.9–7. Collocation Alternative Accident Impacts at Hanford Site

Accident Description	Worker at 1,000 m		Maximum Offsite Individual		Population to 80 km		
	Risk of Cancer Fatality (per 50 yr) ^a	Probability of Cancer Fatality ^b	Risk of Cancer Fatality (per 50 yr) ^a	Probability of Cancer Fatality ^b	Risk of Cancer Fatalities (per 50 yr) ^a	Number of Cancer Fatalities ^c	Accident Frequency (per year)
PCV puncture by forklift	1.3×10^{-7}	4.4×10^{-6}	1.3×10^{-9}	4.4×10^{-8}	9.6×10^{-6}	3.2×10^{-4}	6.0×10^{-4}
PCV breach by firearms discharge	7.7×10^{-9}	4.4×10^{-7}	7.7×10^{-11}	4.4×10^{-9}	5.6×10^{-7}	3.2×10^{-5}	3.5×10^{-4}
PCV penetration by corrosion	5.7×10^{-5}	1.8×10^{-5}	5.7×10^{-7}	1.8×10^{-7}	4.2×10^{-3}	1.3×10^{-3}	0.064
Vault fire	5.8×10^{-8}	0.012	4.6×10^{-10}	9.2×10^{-5}	3.4×10^{-6}	0.67	1.0×10^{-7}
Truck bay fire	3.1×10^{-9}	6.1×10^{-4}	3.1×10^{-11}	6.1×10^{-6}	2.2×10^{-7}	0.045	1.0×10^{-7}
Spontaneous combustion	3.1×10^{-11}	8.8×10^{-7}	3.1×10^{-13}	8.8×10^{-9}	2.2×10^{-9}	6.4×10^{-5}	7.0×10^{-7}
Explosion in the vault	7.2×10^{-9}	1.4×10^{-3}	7.2×10^{-11}	1.4×10^{-5}	5.3×10^{-7}	0.11	1.0×10^{-7}
Explosion outside of vault	3.3×10^{-11}	6.6×10^{-6}	3.3×10^{-13}	6.6×10^{-8}	2.4×10^{-9}	4.8×10^{-4}	1.0×10^{-7}
Nuclear criticality	2.1×10^{-11}	4.2×10^{-6}	1.6×10^{-13}	3.3×10^{-8}	1.8×10^{-10}	3.5×10^{-5}	1.0×10^{-7}
Beyond evaluation basis earthquake	1.1×10^{-7}	0.022	8.3×10^{-10}	1.7×10^{-4}	6.1×10^{-6}	1.2	1.0×10^{-7}
Expected risk ^d	5.8×10^{-5}	–	5.8×10^{-7}	–	4.3×10^{-3}	–	–

^a The risk values are calculated by multiplying the probability of cancer fatality (for the worker at 1,000 m or the maximum offsite individual) or the number of cancer fatalities (for the population to 80 km) by the accident frequency and the number of years of operation.

^b Increased likelihood (or probability) of cancer fatality to a hypothetical individual (a single onsite worker at a distance of 1,000 m or the site boundary, whichever is smaller or to a hypothetical individual in the offsite population located at the site boundary) if exposed to the indicated dose. The value assumes the accident has occurred.

^c Estimated number of cancer fatalities in the entire offsite population out to a distance of 80 km if exposed to the indicated dose. The value assumes the accident has occurred.

^d Expected risk is the sum of the risks for each accident over the 50-year lifetime of the facility.

Note: All values are mean values.

Source: Calculated using the source terms in Tables M.5.2.2.1–3 and M.5.2.2.1–4 and the MACCS computer code.

Phaseout

Normal Operation. A phaseout of existing Pu storage facilities at Hanford would reduce the impacts from radiological and chemical releases and exposures to levels slightly less than the No Action exposures. As shown in Table 4.2.1.9–1, the dose to the MEI from annual operation would be reduced by 4.1×10^{-4} mrem; the dose to the population would be reduced by 0.047 person-rem. The associated reductions in fatal cancer are included in the table. All workers involved in the transfer of the Pu would be monitored to assure that their doses remain within regulatory limits and ALARA.

Facility Accidents. The phaseout operation will be conducted in accordance with DOE Orders to ensure that the risk to the public of prompt fatalities due to accidents or of cancer fatalities due to operations will be minimized. For current operations in the facility that would be phased out, the safety of workers and the public from accidents is controlled by Technical Safety Requirements that are specified in SARs or Basis for Interim Operations documents that have been prepared for the facility. Prior to initiating phaseout, the potential for accidents that could affect workers and the public will be assessed and, if necessary, applicable existing safety documentation will be modified to ensure safety for workers and the public.

4.2.1.10 Waste Management

This section summarizes the impacts on waste management at Hanford under No Action, each of the long-term storage alternatives, and the phaseout of Pu storage. There is no spent nuclear fuel or HLW associated with Pu or HEU storage. Table 4.2.1.10-1 lists the projected sitewide waste generation rates and treatment, storage, disposal capacities under No Action for 2005. Projections for No Action were derived from the most recent available environmental data, with the assumption that operational requirements for waste generation in 2005 would be approximately equal to the 1993 generation volume. The projection does not include wastes from future, yet uncharacterized environmental restoration activities, such as content characterization and decommissioning of 149 single shell tanks, treating 28 double shell tanks, and removing over 500 buildings. The projections for No Action could change significantly depending on the decisions resulting from the PEIS on waste management being prepared by DOE. Table 4.2.1.10-2 provides the estimated incremental operational waste volumes projected to be generated at Hanford as a result of the various storage alternatives prior to treatment. Some of the waste values described in this section are different than the waste values in the table. For those values that differ (for example LLW), the table gives waste generated pre-treatment values and the text discusses post-treatment values (indicated as after treatment and volume reduction). The waste volumes generated from the various storage alternatives and the resultant waste effluent used for the waste impacts analysis can be found in Section E.3.1. Facilities that would support the storage of Pu and/or HEU would treat and package all waste generated into forms that would enable staging and/or disposal in accordance with RCRA and other applicable statutes. Depending in part on decisions in waste-type-specific RODs for the Waste Management PEIS, wastes could be treated and disposed of onsite or at regionalized or centralized DOE sites. For the purposes of analyses only, this PEIS assumes that TRU and mixed TRU waste would be treated onsite to the current planning-basis WIPP WAC, and shipped to WIPP for disposal. This PEIS also assumes that LLW, mixed LLW, hazardous, and nonhazardous wastes would be treated and disposed of in accordance with current site practice.

Preferred Alternative: No Action Alternative

Under this alternative, high-level, TRU, low-level, mixed, hazardous, and nonhazardous wastes, and spent nuclear fuel would continue to be managed from the missions outlined in Section 3.2. Hanford no longer has a weapons production mission. Its focus is to decommission the reactors and site facilities, as well as cleanup approximately 1,450 km² (560 mi²) of land. The impacts of the wastes generated as part of environmental restoration and D&D activities are addressed in the *Final Environmental Impact Statement: Decommissioning of Eight Surplus Production Reactors at the Hanford Site, Richland, Washington* (DOE/EIS-0119F) and the *Draft Hanford Remedial Action Environmental Impact Statement and Comprehensive Land Use Plan* (DOE/EIS-0222D). Under No Action, Hanford would continue to store its inventory of Pu, and treat, store, and dispose of its legacy and newly generated wastes in current and planned facilities.

The Pu addressed in this PEIS is limited to materials currently stored within protected vaults and gloveboxes, and additional materials within process lines and process equipment within the PFP Complex in the 200 West Area. The PFP had been used to conduct Pu processing operations such as Pu purification, Pu recovery, oxide production, metal production, and parts fabrication. The PFP has also been used for receipt and large-scale storage of onsite and offsite Pu scrap and product materials. [Text deleted.] Modifications to the facilities will proceed following the ROD resulting from the PFP EIS (DOE/EIS-0244F) to meet current regulations and provide for interim storage. Maintenance, assay, packaging, and monitoring of the inventory would produce TRU, low-level, hazardous, and nonhazardous wastes. These wastes would be treated, stored, and disposed of in compliance with existing regulations.

Under No Action, the processing of legacy wastes would require new facilities, since the necessary treatment, storage, and disposal facilities either do not exist or are nearing capacity. Spent nuclear fuel would be managed in accordance with the amended ROD (61 FR 9441) from the *Department of Energy Programmatic Spent Nuclear Fuel Management and Idaho National Engineering Laboratory Environmental Restoration and Waste*

Management Programs Final Environmental Impact Statement (DOE/EIS-0203-F) and the ROD (61 FR 10736) from the follow-on tiered site-specific NEPA analysis, *Final Environmental Impact Statement on the Management of Spent Nuclear Fuel from the K Basins at the Hanford Site, Richland, Washington* (DOE/EIS-0245). TRU waste already packaged to current planning-basis WIPP WAC would either be stored or have been shipped. In compliance with the *Federal Facility Compliance Act* of 1992, mixed waste would have been treated and disposed of according to the Hanford Tri-Party Agreement. Solid LLW would continue to be buried at the onsite low-level disposal facility.

Upgrade Alternative

Upgrade Without Rocky Flats Environmental Technology Site or Los Alamos National Laboratory Plutonium Subalternative

Modify Existing Fuels and Materials Examination Facility for Plutonium Storage

The modification of the FMEF or construction of a new storage facility for the continued storage of Pu would have a small impact on existing Hanford waste management activities. Construction waste volumes as presented in Table E.3.1.1-1 would have minimal impact on Hanford waste management activities. Waste generated during construction would consist of wastewater and solid nonhazardous and hazardous wastes. Nonhazardous waste would be disposed of as part of the construction project by the contractor, and the hazardous waste would be shipped offsite to commercial RCRA-permitted treatment and disposal facilities. Operational waste volumes as shown in Table 4.2.1.10-2 would increase slightly due to increased surveillance activities over No Action.

Approximately 20 m³ (26 yd³) of TRU waste from damaged PCVs and contaminated glovebox panels, windows, and gaskets would need to be treated and packaged to meet the current planning-basis WIPP WAC or alternative treatment level. While awaiting shipment to WIPP (depending on decisions made in the ROD associated with the supplemental EIS for the proposed continued phased development of WIPP for disposal of TRU waste), the TRU waste would be stored in above-grade storage facilities at the Hanford Central Waste Complex and the Transuranic Waste Storage and Assay Facility. Three additional truck shipments per year or, if applicable, two regular train shipments per year or one dedicated train shipment every 3 years, would be required to transport this waste to WIPP.

After treatment and volume reduction, approximately 42 m³ (56 yd³) of LLW from solidified liquid LLW (such as decontamination solutions), protective clothing, HEPA filters, glovebox gloves, and decontamination equipment and materials would require disposal in the 200 Area LLW Burial Grounds. Assuming a land usage of 3,400 m³/ha (1,800 yd³/acre), this would require 0.01 ha/yr (0.03 acre/yr) of LLW disposal area.

Contaminated shielding and cleaning materials would be the major contributors to the 5 m³ (7 yd³) of mixed LLW. This small amount of mixed LLW could be treated and disposed of in accordance with the Hanford Tri-Party Agreement through the use of existing and planned facilities.

The 0.57 m³ (150 gal) of liquid hazardous waste such as lubricants, cleaning solvents, paint, and lube oil and 4 m³ (5 yd³) of solid hazardous waste such as lead packing, wipes, and solid materials contaminated with oils, lubricants, and cleaning solvents would have minimal impact on waste management activities at Hanford. The hazardous wastes would be packaged in DOT-approved containers and shipped offsite to commercial RCRA-permitted treatment and disposal facilities.

Approximately 8,330 m³ (2,200,000 gal) of liquid nonhazardous waste to include sanitary, utility and process wastewaters, and cooling system blowdown would be processed using the 200 West Area Treatment Facility or one of the numerous septic tanks/subsurface disposal systems. Existing and planned liquid nonhazardous waste facilities are adequate. After volume reduction, approximately 459 m³ (600 yd³) of solid nonhazardous waste

such as clean non-Pu metals, packing materials, office trash, defective and damaged equipment, and industrial waste from utility and maintenance operations would be shipped to one of the onsite landfills.

Construct New 200 West Area Facility for Plutonium Storage

The construction and operation of a new storage facility for the continued storage of the current inventory of Pu would have a small impact on existing Hanford waste management activities. The impacts are identical to those identified in the preceding option of modifying the FMEF.

Upgrade With All or Some Rocky Flats Environmental Technology Site and Los Alamos National Laboratory Plutonium Subalternative

Modify Existing Fuels and Materials Examination Facility for Plutonium Storage

As shown in Table E.3.1.1–5 construction waste volumes would increase for the additional required construction. The types of operational waste are identical to those discussed earlier, but there would be a small increase in volume. Approximately 21 m³ (27 yd³) of TRU waste would be treated and packaged to meet the current planning-basis WIPP WAC or alternative treatment level. While awaiting shipment to WIPP (depending on decisions resulting from the supplemental PEIS noted earlier), the TRU and mixed TRU waste would be stored in above-grade storage facilities in the Hanford Central Waste Complex and the Transuranic Waste Storage and Assay Facility. Three additional truck shipments per year or, if applicable, two regular train shipments per year or one dedicated train shipment every 3 years, would be required to transport these wastes to WIPP.

After treatment and volume reduction, approximately 45 m³ (59 yd³) of LLW would require disposal in the 200 Area LLW Burial Grounds. Assuming a land usage of 3,400 m³/ha (1,800 yd³/acre), this would require 0.01 ha/yr (0.03 acre/yr) of LLW disposal area. The 5 m³ (7 yd³) of solid mixed LLW would be treated and disposed of in accordance with the Hanford Tri-Party Agreement through the use of existing and planned facilities. The 0.57 m³ (150 gal) of liquid hazardous wastes and 4 m³ (5 yd³) of solid hazardous wastes would have minimal impact on waste management activities at Hanford. The hazardous wastes would be packaged in DOT-approved containers and shipped offsite to commercial RCRA-permitted treatment and disposal facilities. Approximately 8,780 m³ (2,320,000 gal) of liquid nonhazardous wastes to include sanitary, utility and process wastewaters, and cooling system blowdown would be processed using the 200 West Area Treatment Facility or one of the numerous septic tanks/subsurface disposal systems. Existing and planned liquid nonhazardous waste facilities are adequate. After volume reduction, approximately 483 m³ (632 yd³) of solid nonhazardous waste would require disposal at one of the onsite landfills.

Distributing the RFETS and LANL material to more than one site would reduce the operational waste volumes. The decrease would be proportional to the amount of material.

Construct New 200 West Area Facility for Plutonium Storage

The impacts of constructing and operating a new storage facility to include RFETS and LANL Pu would be identical to those identified in the preceding option of modifying the FMEF to include RFETS and LANL Pu.

Consolidation Alternative

Construct New Plutonium Storage Facility

Construction and operation of a consolidated Pu storage facility would have an impact on existing Hanford waste management activities, increasing the generation of TRU, low-level, mixed, hazardous, and nonhazardous wastes. Waste generated during construction would consist of wastewater and solid nonhazardous

and hazardous wastes. The solid nonhazardous waste would be disposed of as part of the construction project by the contractor, and the hazardous waste would be shipped to commercial RCRA-permitted treatment and disposal facilities. No soil contaminated with hazardous or radioactive constituents is expected to be generated during construction. However, if any was generated it would be managed in accordance with site practice and all applicable Federal and State regulations. The types of operational wastes from the consolidated Pu storage facility would be the same as those from the Upgrade Alternative, but the quantity would change.

After treatment and volume reduction of TRU waste, approximately 5 m³ (7 yd³) of TRU waste and 4 m³ (5 yd³) of mixed TRU waste from leaded gloves and windows and contaminated lead shielding would be treated and packaged to meet the current planning-basis WIPP WAC or alternative treatment level. While awaiting shipment to WIPP (depending on decisions resulting from the supplemental EIS noted earlier), the TRU and mixed TRU wastes would be stored in above-grade storage facilities in the Hanford Central Waste Complex and the TRU Waste Storage and Assay Facility. One additional truck shipments per year or, if applicable, one regular train shipment every 2 years or one dedicated train shipment every 6 years, would be required to transport these wastes to WIPP.

Following treatment and volume reduction, approximately 630 m³ (824 yd³) of LLW would require disposal in the 200 Area LLW Burial Grounds. Assuming a land usage of 3,400 m³/ha (1,800 yd³/acre), this would require approximately 0.2 ha/yr (0.5 acre/yr) of LLW disposal area. The 0.2 m³ (50 gal) of liquid mixed LLW and 65 m³ (85 yd³) of solid mixed LLW would be treated and disposed of in accordance with the Hanford Tri-Party Agreement through the use of existing and planned facilities. The 2 m³ (476 gal) of liquid hazardous waste and 2 m³ (3 yd³) of solid hazardous waste would have minimal impact on waste management activities at Hanford. The hazardous wastes would be packaged in DOT-approved containers and shipped offsite to commercial RCRA-permitted treatment and disposal facilities. Approximately 110,000 m³ (29,000,000 gal) of liquid nonhazardous waste would be treated and recycled by the consolidated facility. After volume reduction, 570 m³ (746 yd³) of solid nonhazardous waste would require disposal at one of the onsite landfills.

Collocation Alternative

Construct New Plutonium and Highly Enriched Uranium Storage Facilities

Construction and operation of a consolidated Pu storage facility collocated with HEU storage would have an impact on existing Hanford waste management activities, increasing the generation of TRU, low-level, mixed, hazardous, and nonhazardous wastes. Waste generated during construction would consist of wastewater and solid nonhazardous and hazardous wastes. The solid nonhazardous waste would be disposed of as part of the construction project by the contractor, and the hazardous waste would be shipped to commercial RCRA-permitted treatment and disposal facilities. No soil contaminated with hazardous or radioactive constituents is expected to be generated during construction. However, if any was generated it would be managed in accordance with site practice and all applicable Federal and State regulations. Since there is no TRU or mixed TRU wastes associated with HEU storage, the impacts from TRU and mixed TRU wastes are identical to those identified in the consolidated Pu storage alternative. The sources of waste are similar to those of the Pu storage facilities except the source of radioactive contamination from HEU storage is uranium.

Following treatment and volume reduction, approximately 630 m³ (824 yd³) of LLW contaminated with Pu and 20 m³ (26 yd³) of LLW contaminated with uranium would require disposal in the 200 Area LLW Burial Grounds. Assuming a land usage of 3,400 m³/ha (1,800 yd³/acre), this would require approximately 0.2 ha/yr (0.5 acre/yr) of LLW disposal area. The 0.2 m³ (55 gal) of liquid mixed LLW and 66 m³ (86 yd³) of solid mixed LLW would be treated and disposed of in accordance with the Hanford Tri-Party Agreement through the use of existing and planned facilities. The 2 m³ (530 gal) of liquid hazardous waste and 2 m³ (3 yd³) of solid hazardous waste would have minimal impact on waste management activities at Hanford. The hazardous wastes would be packaged in DOT-approved containers and shipped offsite to commercial RCRA-permitted treatment and disposal facilities. The 146,000 m³ (39,000,000 gal) of liquid nonhazardous waste would require construction

of sanitary, utility, and process wastewater treatment systems. After volume reduction 880 m³ (1,150 yd³) of solid nonhazardous wastes would require disposal at one of the onsite landfills.

Subalternative Not Including Strategic Reserve and Weapons Research and Development Materials

The exclusion of strategic reserve and weapons R&D materials would reduce the amount of operational waste volumes shown in Table 4.2.1.10–2 for the Upgrade With All or Some RFETS and LANL Pu Subalternative, the Consolidation Alternative, and the Collocation Alternative. The decrease would be proportional to the amount of material excluded. [Text deleted.]

Phaseout

The phaseout of Pu storage would have no impact on Hanford waste management activities. The volume of waste would not decrease until the facilities in which Pu is stored were D&D.

4.2.2 NEVADA TEST SITE

A listing of the proposed long-term storage alternatives, subalternatives, and related actions, including the No Action Alternative, at NTS is provided below. The potential impacts of implementing these alternatives and related actions at NTS are described in the following sections: land resources, site infrastructure, air quality and noise, water resources, geology and soils, biological resources, cultural and paleontological resources, socioeconomics, public and occupational health and safety, and waste management. The specific long-term storage alternatives proposed for NTS are the Consolidation Alternative and the Collocation Alternative.

Preferred Alternative

No Action Alternative:

There is no Pu or HEU storage mission currently at NTS; does not add Pu or HEU storage at NTS.

Proposed Storage Activities at Nevada Test Site

- **No Action Alternative (Preferred Alternative):** There is no Pu or HEU storage mission currently at NTS; does not add Pu or HEU storage at NTS.
- **Upgrade Alternative:** This storage alternative does not apply to NTS.
- **Consolidation Alternative:** Two options to accommodate all Pu material within the scope of this PEIS: Modify the existing network of tunnel drifts and construct a new material handling building at the P-Tunnel; or construct a new facility near DAF.
- **Collocation Alternative:** Two options to accommodate all Pu and HEU material within the scope of this PEIS: Modify the existing network of tunnel drifts and construct a larger new material handling building at the P-Tunnel; or construct a larger new facility near the DAF.
- **Subalternative Not Including Strategic Reserve and Weapons Research and Development Materials:** Facility and other resource requirements would be smaller than the Consolidation Alternative and the Collocation Alternative.
- **Phaseout:** This storage activity does not apply to NTS.

4.2.2.1 Land Resources

Preferred Alternative: No Action Alternative

Neither Pu nor HEU is presently stored at NTS. Under the No Action Alternative, existing and planned missions at NTS would continue. The ongoing (no new action) activities would conform with present and future land-use plans, policies, and controls. No effects to land resources would be anticipated at NTS beyond those of existing and future activities that are independent of this action.

Consolidation Alternative

Modify Existing Tunnel Drifts and Construct New Material Handling Building at the P-Tunnel

This option would modify the existing P-Tunnel and construct a new material handling building in Area 12 to accommodate all Pu material within the scope of this PEIS. During construction, 29 ha (72 acres) of land area would be required of which 27 ha (68 acres) would be used during operation. Construction laydown area and the operating facility would be situated entirely on previously disturbed land and would not create any newly disturbed area. As a modification of an existing facility, the 1.6-km (1-mi) buffer zone is established.

Land Use. Utilization of the P-Tunnel in Area 12 would not conform with the master plan of the *Nevada Test Site Development Plan*, which designates the North area of NTS as an underground nuclear weapons test area (NT DOE 1995d:7). However, the P-Tunnel is a potential site for long-term storage and disposition of weapons-usable fissile materials as part of the NTS defense program materials disposition activities considered under the Expanded Use Alternative (part of the Preferred Alternative) of the *Final Environmental Impact Statement for the Nevada Test Site and Off-Site Locations in the State of Nevada* (NTS EIS) (NT DOE 1996c:3-8,3-9; NT DOE 1996e:A-18). Should the Consolidation Alternative P-Tunnel option be selected, the Expanded Use Alternative of the NTS EIS could be used to revise the current *Nevada Test Site Development Plan*. With these changes, any required construction would be consistent with the land use plan. As discussed in Section 4.2.2.8, sufficient available labor exists within the region to fill the jobs created during construction and operations. There would be no increased demand for housing. Therefore, no indirect impacts on offsite land use would be anticipated.

Use of the P-Tunnel would not affect special status lands as shown in Figure 3.3.1-1. The buffer zone and security area associated with the long-term storage alternative would preclude development within the immediate area. However, the NTS EIS Expanded Use Alternative indicates that adequate land area is available at NTS for facility siting (NT DOE 1996c:3-14, 3-15). The proposal would not affect offsite grazing allotments. No prime farmlands exist onsite. The alternative would not be in conflict with land-use plans, policies, or controls of adjacent jurisdictions since none of these counties or municipalities currently undertake land-use planning. Storage of Pu in the P-Tunnel could impact weapons effects testing ability. It is likely that the P-Tunnel be closed during testing, although it could be kept manned if appropriate safety considerations were met (NT DOE 1995e:1). However, the potential for impacts could be eliminated by test or tunnel design (NT DOE 1996f:1).

Visual Resources. [Text deleted.] Construction and operation of the facility would be compatible with the existing industrialized landscape character of Area 12 and the current VRM Class 5 designation. Although U.S. Route 95 is a heavily traveled public roadway, travelers are unable to view Area 12 facilities because of mountainous terrain and distance.

Construct New Plutonium Storage Facility

All Pu within the scope of this PEIS would be stored at a new storage facility to be constructed at NTS Area 6 near the DAF. The consolidated Pu storage plant at NTS would disturb 58.5 ha (144 acres) of land area during

construction of which 56 ha (138 acres) would be used during operation. A buffer zone would be provided between the facility and the NTS site boundary. Pu storage in existing storage facilities at other DOE sites would be phased out.

Land Use. Construction and operation of the Pu facility would convert undeveloped land in Area 6. The proposed action would not conform with the current *Nevada Test Site Development Plan*, which designates the southeast area of NTS as a nonnuclear test area (NT DOE 1995d:7). However, Area 6 is a potential site for long-term storage and disposition of weapons-usable fissile materials as part of the NTS defense program materials disposition activities considered under the Expanded Use Alternative (part of the Preferred Alternative) of the NTS EIS (NT DOE 1996c:3-8,3-9; NT DOE 1996e:A-18). As discussed in Section 4.2.2.8, no in-migration of workers would be required during construction and operations. No increase in housing demand would be anticipated, with offsite land use not subject to indirect land-use impacts.

Construction and operation would not affect other land uses at NTS or special status lands. The buffer zone and security area associated with the long-term storage alternative would preclude development within the immediate area. However, the Expanded Use Alternative of the NTS EIS indicates that adequate land area is available at NTS for facility siting (NT DOE 1996c:3-14,3-15). The alternative would not affect offsite grazing allotments. No prime farmlands exist onsite. The alternative would not be in conflict with land-use plans, policies, or controls of adjacent jurisdictions since none of these counties or municipalities currently undertake land-use planning.

Visual Resources. [Text deleted.] Construction and operation of the facility would be compatible with the industrial landscape character of the adjacent DAF and the current VRM Class 5 designation of Area 6. Views of the alternative would be blocked from sensitive viewpoints accessible to the public by mountainous terrain.

Collocation Alternative

Modify Existing Tunnel Drifts and Construct New Material Handling Building at the P-Tunnel

Under this action, the existing P-Tunnel located in Area 12 is proposed to be utilized, and a new material handling building would be constructed at the P-Tunnel. Land disturbance would be 29 ha (72 acres) during construction of which 27 ha (68 acres) would be used during operations. Construction laydown area and the operating facility would be situated entirely on previously disturbed land and would not create any newly disturbed area. Effects to land resources during construction and operation would be similar to those of the new and modified P-Tunnel for the Consolidation Alternative. As discussed in Section 4.2.2.8, in-migration would occur only during the operation phase. Projected vacancies within the housing stock would be sufficient to accommodate the slight increase in demand. Therefore, no indirect effects to offsite land use would be anticipated.

Construct New Plutonium and Highly Enriched Uranium Storage Facilities

The new storage facility would be located on undisturbed land in Area 6 near the DAF and would disturb a land area of 89.5 ha (221 acres) during construction of which 87 ha (215 acres) would be used during operations. A buffer zone would be provided between operations and the NTS site boundary. Direct and indirect land resources effects would be similar to the Consolidation Alternative, new storage facility.

Subalternative Not Including Strategic Reserve and Weapons Research and Development Materials

Under this subalternative, land effects during construction and operation would be almost the same in extent and magnitude to the Consolidation Alternative and Collocation Alternative because the facility would be almost the

same. However, because the smaller quantity of material would require smaller facilities, it is likely that less land area would be disturbed during construction and used during operations. [Text deleted.]

[Text deleted.]

4.2.2.1 Land Resources

Preferred Alternative: No Action Alternative

Neither Pu nor HEU is presently stored at NTS. Under the No Action Alternative, existing and planned missions at NTS would continue. The ongoing (no new action) activities would conform with present and future land-use plans, policies, and controls. No effects to land resources would be anticipated at NTS beyond those of existing and future activities that are independent of this action.

Consolidation Alternative

Modify Existing Tunnel Drifts and Construct New Material Handling Building at the P-Tunnel

This option would modify the existing P-Tunnel and construct a new material handling building in Area 12 to accommodate all Pu material within the scope of this PEIS. During construction, 29 ha (72 acres) of land area would be required of which 27 ha (68 acres) would be used during operation. Construction laydown area and the operating facility would be situated entirely on previously disturbed land and would not create any newly disturbed area. As a modification of an existing facility, the 1.6-km (1-mi) buffer zone is established.

Land Use. Utilization of the P-Tunnel in Area 12 would not conform with the master plan of the *Nevada Test Site Development Plan*, which designates the North area of NTS as an underground nuclear weapons test area (NT DOE 1995d:7). However, the P-Tunnel is a potential site for long-term storage and disposition of weapons-usable fissile materials as part of the NTS defense program materials disposition activities considered under the Expanded Use Alternative (part of the Preferred Alternative) of the *Final Environmental Impact Statement for the Nevada Test Site and Off-Site Locations in the State of Nevada* (NTS EIS) (NT DOE 1996c:3-8,3-9; NT DOE 1996e:A-18). Should the Consolidation Alternative P-Tunnel option be selected, the Expanded Use Alternative of the NTS EIS could be used to revise the current *Nevada Test Site Development Plan*. With these changes, any required construction would be consistent with the land use plan. As discussed in Section 4.2.2.8, sufficient available labor exists within the region to fill the jobs created during construction and operations. There would be no increased demand for housing. Therefore, no indirect impacts on offsite land use would be anticipated.

Use of the P-Tunnel would not affect special status lands as shown in Figure 3.3.1-1. The buffer zone and security area associated with the long-term storage alternative would preclude development within the immediate area. However, the NTS EIS Expanded Use Alternative indicates that adequate land area is available at NTS for facility siting (NT DOE 1996c:3-14, 3-15). The proposal would not affect offsite grazing allotments. No prime farmlands exist onsite. The alternative would not be in conflict with land-use plans, policies, or controls of adjacent jurisdictions since none of these counties or municipalities currently undertake land-use planning. Storage of Pu in the P-Tunnel could impact weapons effects testing ability. It is likely that the P-Tunnel be closed during testing, although it could be kept manned if appropriate safety considerations were met (NT DOE 1995e:1). However, the potential for impacts could be eliminated by test or tunnel design (NT DOE 1996f:1).

Visual Resources. [Text deleted.] Construction and operation of the facility would be compatible with the existing industrialized landscape character of Area 12 and the current VRM Class 5 designation. Although U.S. Route 95 is a heavily traveled public roadway, travelers are unable to view Area 12 facilities because of mountainous terrain and distance.

Construct New Plutonium Storage Facility

All Pu within the scope of this PEIS would be stored at a new storage facility to be constructed at NTS Area 6 near the DAF. The consolidated Pu storage plant at NTS would disturb 58.5 ha (144 acres) of land area during

construction of which 56 ha (138 acres) would be used during operation. A buffer zone would be provided between the facility and the NTS site boundary. Pu storage in existing storage facilities at other DOE sites would be phased out.

Land Use. Construction and operation of the Pu facility would convert undeveloped land in Area 6. The proposed action would not conform with the current *Nevada Test Site Development Plan*, which designates the southeast area of NTS as a nonnuclear test area (NT DOE 1995d:7). However, Area 6 is a potential site for long-term storage and disposition of weapons-usable fissile materials as part of the NTS defense program materials disposition activities considered under the Expanded Use Alternative (part of the Preferred Alternative) of the NTS EIS (NT DOE 1996c:3-8,3-9; NT DOE 1996e:A-18). As discussed in Section 4.2.2.8, no in-migration of workers would be required during construction and operations. No increase in housing demand would be anticipated, with offsite land use not subject to indirect land-use impacts.

Construction and operation would not affect other land uses at NTS or special status lands. The buffer zone and security area associated with the long-term storage alternative would preclude development within the immediate area. However, the Expanded Use Alternative of the NTS EIS indicates that adequate land area is available at NTS for facility siting (NT DOE 1996c:3-14,3-15). The alternative would not affect offsite grazing allotments. No prime farmlands exist onsite. The alternative would not be in conflict with land-use plans, policies, or controls of adjacent jurisdictions since none of these counties or municipalities currently undertake land-use planning.

Visual Resources. [Text deleted.] Construction and operation of the facility would be compatible with the industrial landscape character of the adjacent DAF and the current VRM Class 5 designation of Area 6. Views of the alternative would be blocked from sensitive viewpoints accessible to the public by mountainous terrain.

Collocation Alternative

Modify Existing Tunnel Drifts and Construct New Material Handling Building at the P-Tunnel

Under this action, the existing P-Tunnel located in Area 12 is proposed to be utilized, and a new material handling building would be constructed at the P-Tunnel. Land disturbance would be 29 ha (72 acres) during construction of which 27 ha (68 acres) would be used during operations. Construction laydown area and the operating facility would be situated entirely on previously disturbed land and would not create any newly disturbed area. Effects to land resources during construction and operation would be similar to those of the new and modified P-Tunnel for the Consolidation Alternative. As discussed in Section 4.2.2.8, in-migration would occur only during the operation phase. Projected vacancies within the housing stock would be sufficient to accommodate the slight increase in demand. Therefore, no indirect effects to offsite land use would be anticipated.

Construct New Plutonium and Highly Enriched Uranium Storage Facilities

The new storage facility would be located on undisturbed land in Area 6 near the DAF and would disturb a land area of 89.5 ha (221 acres) during construction of which 87 ha (215 acres) would be used during operations. A buffer zone would be provided between operations and the NTS site boundary. Direct and indirect land resources effects would be similar to the Consolidation Alternative, new storage facility.

Subalternative Not Including Strategic Reserve and Weapons Research and Development Materials

Under this subalternative, land effects during construction and operation would be almost the same in extent and magnitude to the Consolidation Alternative and Collocation Alternative because the facility would be almost the

same. However, because the smaller quantity of material would require smaller facilities, it is likely that less land area would be disturbed during construction and used during operations. [Text deleted.]

[Text deleted.]

4.2.2.2 Site Infrastructure

Nevada Test Site had an extensive infrastructure to handle the underground test program. With the cessation of nuclear testing, many of the operations around the site have been terminated. However, the facilities remain in place and are considered to be available.

Preferred Alternative: No Action Alternative

The infrastructure currently in place at NTS is capable of handling all anticipated missions and functions associated with the No Action Alternative.

Consolidation Alternative

Modify Existing Tunnel Drifts and Construct New Material Handling Building at the P-Tunnel

Construction to modify the P-Tunnel and construct a new material handling building to accommodate long-term storage of Pu at NTS would not impact the site infrastructure. Data for construction are presented in Appendix C. Operations impacts to NTS infrastructure under this option are in the areas of electrical energy and fuel requirements for the site. As shown in Table 4.2.2.2-1, additional electrical energy would be required to operate the facility. A small amount of oil would be required to operate the modified P-Tunnel for storage of Pu. Since oil availability is governed by usage and not by storage capacity onsite, the additional oil could be procured through normal contractual means. The preconceptual facility design uses natural gas as a fuel source. The final facility design for NTS would be converted to an energy source already available at NTS. With this conversion from natural gas to oil, site infrastructure requirements are within site capacities.

Construct New Plutonium Storage Facility

Constructing a new storage facility to accommodate long-term storage of Pu at NTS would not affect the site infrastructure. Data for construction are presented in Appendix C. Operations impacts to NTS infrastructure under this option are in the area of fuel requirements. As shown in Table 4.2.2.2-1, a small amount of oil would be required to operate the new facility for storage of Pu. Since oil availability is governed by usage and not by storage capacity on site, the additional oil could be procured through normal contractual means. Adequate electrical energy is available from the regional power grid. The preconceptual facility design uses natural gas as a fuel source. The final facility design for NTS would be converted to an energy source already available at NTS. With this conversion from natural gas to oil, site infrastructure requirements are within site capacities.

Collocation Alternative

Modify Existing Tunnel Drifts and Construct New Material Handling Building at the P-Tunnel

Construction to modify the P-Tunnel and construct a new material handling building to accommodate long-term storage of Pu and HEU at NTS would not affect site infrastructure. Data for construction are presented in Appendix C. Operations impacts to NTS infrastructure under this option are in the areas of electrical energy and fuel requirements for the site. As shown in Table 4.2.2.2-1, additional electrical energy would be required to operate the facility. A small amount of oil would be required to operate the modified P-Tunnel for storage of Pu and HEU. Since oil availability is governed by usage and not by storage capacity on site, the additional oil could be procured through normal contractual means. Adequate electrical energy is available from the regional power grid. The preconceptual facility design uses natural gas as a fuel source. The final facility design for NTS would be converted to an energy source already available at NTS. With this conversion from natural gas to another energy source, site infrastructure requirements are within site capacities.

Construct New Plutonium and Highly Enriched Uranium Storage Facilities

Constructing a new storage facility to accommodate long-term storage of Pu and HEU at NTS would not affect the site infrastructure. Data for construction are presented in Appendix C. Operations impacts to NTS infrastructure under this option are in the areas of electrical energy and fuel requirements. As shown in Table 4.2.2.2-1, additional electrical energy would be required to operate the facility. A small amount of oil would be required to operate the new facility for storage of Pu and HEU. Since oil availability is governed by usage and not by storage capacity on site, the additional oil could be procured through normal contractual means. Adequate electrical energy is available from the regional power grid. The preconceptual facility design uses natural gas as a fuel source. The final facility design for NTS would be converted to an energy source already available at NTS. With this conversion from natural gas to oil, site infrastructure requirements are within site capacities.

Subalternative Not Including Strategic Reserve and Weapons Research and Development Materials

With a change to the preconceptual facility designs that would allow use of a fuel source already in place at NTS, the existing site infrastructure would be fully capable of supporting construction/modification and operation of facilities for the Consolidation of Pu and Collocation of Pu and HEU Alternatives. With this change, constructing and operating such alternatives, without including provisions for storage of strategic reserve and weapons R&D materials could be accommodated as well. Expected reductions in annual electrical energy requirements from that of the various storage alternatives for all the nonsurplus materials are the only site infrastructure changes expected if this subalternative is chosen because electric usage is dependent on the amount of material. [Text deleted.]

4.2.2.3 Air Quality and Noise

Construction and operation activities associated with the No Action Alternative and the proposed storage alternatives would generate criteria and toxic/hazardous pollutants. To evaluate the air quality impacts at NTS, criteria and toxic/hazardous concentrations from the No Action Alternative and the proposed storage alternatives are compared with Federal and State standards and guidelines. Impacts from radiological airborne emissions are described in Section 4.2.2.9.

In general, all of the proposed storage facilities would emit the same types of air pollutants during construction. It is expected emissions would not exceed Federal, State, or local air quality regulations. PM₁₀ concentrations will be increased especially during peak construction periods.

The principal sources of emissions during construction include the following:

- Fugitive dust from land clearing, site preparation, excavation, and wind erosion of exposed ground surfaces
- Exhaust and road dust generated by construction equipment, vehicles delivering construction materials, and vehicles carrying construction workers

During operation, impacts from each of the individual storage facilities with respect to the concentrations of criteria and toxic/hazardous air pollutants are predicted to be in compliance with Federal, State, and local air quality regulations or guidelines. Table 4.2.2.3–1 presents the estimated pollutant concentrations for each of the storage alternatives, indicating little difference between alternatives with respect to impacts to air quality.

Emission rates attributed to operation of the proposed storage facilities are presented in Tables F.1.3–2 and F.1.3–3. [Text deleted.] Air pollutant emission sources associated with operations include the following:

- Operation of boilers for space heating
- Operation of diesel generators and periodic testing of emergency diesel generators
- Exhaust and road dust generated by vehicles delivering supplies and bringing employees to work
- Toxic/hazardous pollutant emissions from facility processes

Noise impacts during either construction or operation are expected to be low. Air quality and noise impacts for each storage alternative are described separately. Supporting data for the air quality and noise analyses are presented in Appendix F.

AIR QUALITY

An analysis was conducted of the potential air quality impacts of emissions from each of the storage alternatives as described in Section 4.1.3.

Section 176 (c) of the 1990 CAA Amendments requires that all Federal actions conform with the applicable SIP. EPA has implemented rules that establish the criteria and procedures governing the determination of conformity for all Federal actions in nonattainment and maintenance areas. These are discussed in Section 4.1.3. The attainment status of the area in which NTS is located is discussed in Section 3.3.3. Since the area is considered to be an attainment area for the criteria pollutants, the proposed actions at this site do not require that a conformity analysis be performed.

Preferred Alternative: No Action Alternative

This alternative utilizes estimated air emissions data from operations at NTS assuming continuation of site missions as described in Section 3.3. The emission rates for the criteria and toxic/hazardous pollutants for No Action are presented in Table F.1.2.3-1. Table 4.2.2.3-1 presents the No Action concentrations for the total site. Concentrations of all criteria and toxic/hazardous air pollutants at the site boundary are expected to remain within applicable Federal, State, and local ambient air quality standards.

Consolidation Alternative

Modify Existing Tunnel Drifts and Construct New Material Handling Building at the P-Tunnel

In addition to the sources of emissions during construction associated with the No Action Alternative, fugitive dust resulting from the operation of a concrete batch plant may be an additional emission source associated with a new facility.

Increases in PM₁₀ concentrations may occur during the peak construction period for a new facility and during dry and windy conditions. Appropriate control measures would be followed to minimize pollutant concentrations during construction. Concentrations of all pollutants at the site boundary would remain within applicable Federal and State ambient air quality standards during construction.

During operation of the modified P-Tunnel, impacts with respect to the concentrations of criteria and toxic/hazardous air pollutants are predicted to be in compliance with Federal, State, and local air quality regulations or guidelines. Estimated pollutant concentrations attributable to increased operations associated with this storage alternative, plus the No Action concentrations, are presented in Table 4.2.2.3-1.

Construct New Plutonium Storage Facility

The new storage facility option would have air quality impacts similar to those of the modified P-Tunnel, with the following exceptions. During operation, emissions would be slightly lower, as shown in Appendix F. Impacts for the new storage facility option with respect to the concentrations of criteria pollutants are predicted to be in compliance with Federal, State, and local air quality regulations or guidelines. Estimated pollutant concentrations attributable to increased operations associated with this option for the storage alternative, plus the No Action concentrations, are presented in Table 4.2.2.3-1.

Collocation Alternative

Modify Existing Tunnel Drifts and Construct New Material Handling Building at the P-Tunnel

The P-Tunnel option would have slightly higher emissions than for the consolidation of Pu modified P-Tunnel, as shown in Appendix F. Impacts for this alternative are also expected to be in compliance with Federal, State, and local air quality regulations and guidelines. Estimated pollutant concentrations attributable to increased operations associated with this option for the storage alternative, plus the No Action concentrations, are presented in Table 4.2.2.3-1.

Construct New Plutonium and Highly Enriched Uranium Storage Facilities

The new storage facility option would be located in the same area as the consolidation of Pu new storage facility and would have similar air quality impacts with the following exceptions.

During operation, emissions would be slightly higher than for consolidation of Pu new storage facility option, as shown in Appendix F. Impacts for the new storage facilities option with respect to the concentrations of criteria and toxic/hazardous air pollutants are predicted to be in compliance with Federal, State, and local air quality regulations or guidelines. Estimated pollutant concentrations attributable to increased operations associated with this option for the storage alternative, plus the No Action concentrations, are presented in Table 4.2.2.3-1.

Subalternative Not Including Strategic Reserve and Weapons Research and Development Materials

Air quality impacts for construction and operations for this subalternative are expected to be similar to those previously described for the Consolidation Alternative and the Collocation Alternative. [Text deleted.]

NOISE

The location of the storage facilities relative to the site boundary and sensitive receptors was examined to evaluate the potential for onsite and offsite noise impacts. Noise sources during construction may include heavy construction equipment and increased traffic. Increased traffic would occur onsite and along offsite local and regional transportation routes used to bring construction material and workers to the site.

Preferred Alternative: No Action Alternative

Nontraffic noise sources associated with continued interim storage and other ongoing missions would be the same as described in Chapter 3. The continuation of operations at NTS would result in no appreciable change in traffic noise and onsite operational noise sources from current levels. Nontraffic noise sources are located at sufficient distance from offsite areas that the contribution to offsite noise levels would continue to be small. Due to the size of the site, noise emissions from construction equipment and operations activities would not be expected to cause annoyance to the public. Some noise sources may be located close enough to onsite noise sensitive areas to result in impacts, such as disturbance of wildlife.

Consolidation and Collocation Alternatives

Nontraffic, operational noise sources associated with the storage alternatives include existing or additional equipment and machines (cooling systems, vents, motors, and material handling equipment). These noise sources would be located at sufficient distance from offsite areas that the contribution to offsite noise levels would be small. Due to the size of the site, noise emissions from construction equipment and operations activities would not be expected to cause annoyance to the public. Some noise sources may result in impacts, such as disturbance of wildlife.

Subalternative Not Including Strategic Reserve and Weapons Research and Development Materials

Noise impacts for construction and operations for this option are expected to be almost the same as those previously described for the Consolidation Alternative and the Collocation Alternative because noise impacts are based on the use of the facility and not the size. [Text deleted.]

4.2.2.4 Water Resources

Construction and operation of the potential long-term storage facilities at NTS could affect water resources. All water required for construction and operation would be supplied from groundwater. The proposed facilities do not lie within areas historically prone to flooding. During construction, treated sanitary wastewater would be discharged to containment and sewage ponds, which would be built in accordance with applicable regulations to avoid impacts on groundwater. While the potential impacts to surface waters during the construction phase would be erosion and sedimentation, the relatively dry climate, along with the implementation of best management practices for stormwater runoff and erosion control, should preclude these potential impacts. No excess wastewater would be discharged to surface waters during the operation of the facilities, so no impacts to surface water quality are expected. Stormwater runoff would be collected and treated, if necessary, before discharge to natural drainage channels. [Text deleted.] Table 4.2.2.4-1 presents No Action water resources uses and discharges and the potential changes to water resources at NTS resulting from the long-term storage alternatives.

Preferred Alternative: No Action Alternative

Surface Water. A description of the activities that would continue at NTS is provided in Section 3.3.4. Under this alternative, no impacts to surface water resources are anticipated because there are no surface water withdrawals, offsite surface drainage system, or publicly owned treatment works. Treated wastewater discharged to evaporation/infiltration ponds is expected to continue at a rate of 82 million l/yr (21.7 million gal/yr). Contamination that has occurred from past practices and is limited to onsite areas would continue to be characterized and remediated.

Groundwater. Under this alternative, no additional impacts to groundwater availability or quality are anticipated. Baseline conditions and operations, described in Section 3.3 would continue at NTS. Current groundwater usage of 2,400 million l/yr (634 million gal/yr) is not anticipated to increase by the year 2005. Groundwater would continue to be withdrawn from local groundwater sources. No additional impacts to groundwater quality are anticipated since there are no direct discharges to groundwater.

Consolidation Alternative

Modify Existing Tunnel Drifts and Construct New Material Handling Building at the P-Tunnel

Surface Water. No surface water would be withdrawn during construction or operation of the proposed facilities. Consequently, impacts to surface water availability and quality are not expected. Approximately 7.8 million l/yr (2.1 million gal/yr) of nonhazardous wastewater would be generated during construction and subsequently treated, and discharged to evaporation/infiltration ponds that would be designed to minimize seepage. No impacts to surface water from these discharges are expected, because wastewaters are not discharged to natural flowing surface water bodies.

[Text deleted.]

During operation, utility, process, and sanitary wastewater from the proposed facilities would be treated and recycled. Treated effluent would be monitored to comply with discharge permit limits. The extent to which treated effluent or stormwater would be recycled for reuse within the plant would be determined during site-specific studies.

[Text deleted.]

There have been no studies conducted to assess the 500-year floodplain at NTS. However, information on the location of the 500-year floodplain could be developed as part of the siting process. Studies of the 100-year

floodplain showed it to be confined to the Jackass Flats and Frenchman Lake areas. The proposed site for the new Pu storage facilities is outside these areas. However, since NTS is in a region where most flooding occurs by locally intense thunderstorms that can create brief (less than 6 hours) flash floods, the facilities would be designed to withstand such flooding.

Groundwater. All water required for construction and operation would be supplied from groundwater via the existing supply system. The Lower and Upper Carbonate, the Volcanic, and the Valley-Fill Aquifers are the source of water for operations at NTS. Groundwater required for construction (35 million l/yr [9 million gal/yr]) and operation (130 million l/yr [34.3 million gal/yr]) would represent a 1.5- and 5.4-percent maximum increase, respectively, over the projected No Action 2005 groundwater withdrawal, and 0.09- and 0.3-percent, respectively, of the minimum estimated annual recharge to the regional aquifer under the entire NTS. This is based on several studies conducted in recent years, which estimated recharge to be 38 to 57 billion l (10 to 15 billion gal). These amounts would also be within NTS's allotment and would not be expected to cause depletion of the aquifer. Groundwater required for both construction and operation and the percent increase in projected water use is shown in Table 4.2.2.4-1.

Construction and operation of the potential modified P-Tunnel drifts would not result in direct discharges to groundwater. Recycling of all treated wastewater is expected. However, if treated wastewater generated during construction was discharged to disposal ponds it could percolate downward into the groundwater of the Valley-Fill Aquifer. This water would be monitored and would not be discharged until contaminant levels are within the limits specified. In addition, other factors contributing to a lessening of potential impacts to groundwater are the combined effects of a deep water table, low discharge volumes, and high evaporation rates. Similarly, some stormwater runoff and other discharges routed to storm drains could percolate into the subsurface. These discharges would be monitored and no impacts to groundwater quality are expected.

Construct New Plutonium Storage Facility

Surface Water. There are no unique construction characteristics associated with water requirements and discharges from a new Pu storage facility. No surface water would be withdrawn for any construction or operation activities associated with any of the proposed facilities. Therefore, there would be no impacts to surface water availability. During the construction phase, approximately 7.8 million l/yr (2.1 million gal/yr) of nonhazardous wastewater would be generated. This treated wastewater would be discharged to evaporation/infiltration ponds. No impacts to surface water from these discharges are expected, because wastewaters are not discharged to natural flowing surface waterbodies.

[Text deleted.]

During operation, utility, process, and sanitary wastewater from the proposed facilities would be treated and recycled to the cooling tower and/or boiler. Cooling system blowdown is directed to the utility wastewater treatment facility and is also recycled for use as cooling tower makeup. Treated effluent would be monitored to comply with discharge permit limits. Floodplain issues are the same as described for the previous alternative.

[Text deleted.]

Groundwater. All water required for construction and operation would be supplied from groundwater via the existing supply system. Groundwater required for both construction and operation and the percent increase in projected water use are shown in Table 4.2.2.4-1 for operations at NTS.

Construction and operation water requirements for the proposed facilities (85 million l/yr [22.5 million gal/yr], and 110 million l/yr [30 million gal/yr]) represent approximately 0.2 and 0.3 percent of the minimum estimated annual recharge (38 billion l [10 billion gal]) to the regional aquifer under the entire NTS. As shown in Table 4.2.2.4-1, the quantities of water required for construction and operation of the proposed facilities

represent approximately 3.5- and 4.6-percent increases over the projected No Action groundwater usage. These small increases boost the total projected groundwater withdrawal to less than 7 percent of the estimated annual recharge; there should be no impact on groundwater availability.

Construction and operation of the proposed consolidated Pu storage facilities would not result in direct discharges to groundwater. Recycling of all treated wastewater is expected. However, if treated wastewater generated during construction was discharged to disposal ponds it could percolate downward into the groundwater of the Valley-Fill Aquifer. This water would be monitored and would not be discharged until contaminant levels are within the limits specified. In addition, other factors contributing to a lessening of potential impacts to groundwater are the combined effects of a deep water table, low discharge volumes, and high evaporation rates. Impacts to groundwater quality are therefore not expected.

Similarly, some stormwater runoff and other discharges routed to storm drains could percolate into the subsurface. These discharges would be monitored under the State of Nevada stormwater regulations and therefore no impacts to groundwater quality are expected.

Collocation Alternative

Modify Existing Tunnel Drifts and Construct New Material Handling Building at the P-Tunnel

Surface Water. Under this alternative, modifying the P-Tunnel would increase water discharges by 10.6 percent over the projected No Action discharge during construction. During operations, wastewater would be recycled. All other wastewater requirements of the option would be similar to modifying P-Tunnel under the Consolidation Alternative.

Groundwater. During construction, the Pu and HEU storage upgrade using the P-Tunnel would require 35 million l/yr (9.2 million gal/yr) of groundwater, or a 1.5-percent increase over projected No Action water use. During operations, 190 million l/yr (50.2 million gal/yr) of water would be required, a 7.9-percent increase over the projected No Action water use, representing 0.5 percent of the minimum estimated recharge. All other water requirements of the option are identical to those discussed previously for modifying the P-Tunnel.

Construct New Plutonium and Highly Enriched Uranium Storage Facilities

Since the new Pu and HEU collocated storage facilities would be located in the same area as the new Pu storage facility, the impacts associated with them are similar to those previously discussed for the Consolidation New Storage Facility Alternative, with the following exceptions. Sanitary wastewater quantities generated during construction would be greater than for the new storage facility option and are approximately 11.8 million l/yr (3.1 million gal/yr). These effluents would be discharged to evaporation/infiltration ponds under a State of Nevada permit. No impacts are expected. During operations, wastewater would be recycled. The groundwater requirements for construction of this option are greater than those for the previous option. This option would require approximately 104.7 million l/yr (27.7 million gal/yr) and 150 million l/yr (39.6 million gal/yr) for construction and operation, respectively. These additional requirements represent 4.4- and 6.3-percent increases, respectively, in the projected No Action groundwater withdrawals. These amounts increase the total projected site groundwater withdrawal to less than 7 percent of the estimated annual recharge; there should be no impact on groundwater availability.

Subalternative Not Including Strategic Reserve and Weapons Research and Development Materials

Water resource impacts for construction and operation of this option are expected to be slightly less than those described for the Consolidation Alternative and the Collocation Alternative because of the reduction in the amount of material. [Text deleted.]

4.2.2.5 Geology and Soils

Construction and operation of the alternatives at NTS would have no effect on the geologic resources. A moderate seismic risk exists, but would be considered in the design of the proposed alternatives. The existing seismic risk does not preclude the safe construction and operation of the proposed alternative facilities. The facilities would be designed for earthquake-generated ground accelerations, in accordance with DOE O 420.1, *Facility Safety*. The Yucca and Carpet Bag faults are considered to be capable faults and represent a potential for ground rupture as a result of an earthquake. However, ground shaking is more likely in the areas of the proposed alternatives. Intensities of approximately VII on the MMI scale are possible at NTS. A peak ground acceleration of 0.67 g with a Richter magnitude of 6.7, has been estimated for the Cane Spring fault, with a recurrence interval of 10,000 to 30,000 years. This could affect the integrity of inadequately designed or nonreinforced structures but should not affect newly designed facilities. Human health effects from accidents initiated by natural phenomenon (for example, earthquakes) are discussed in Section 4.2.2.9. Volcanic activity is improbable during the life of the alternatives and is not anticipated to affect the construction and operation of the alternatives. The most likely risk to NTS is possible ash fall from the Long Valley, California area located approximately 214 km (150 mi) to the west-northwest. Lava extrusions from sources at NTS could recur but are unlikely. Precursors, such as shallow earthquakes, gas venting activity, and an increase in groundwater temperatures provide advance warning of most eruptions of this type; no such activity is currently indicated at NTS. It is unlikely that landslides, sinkhole development, or other nontectonic events would affect project activities. Slopes and underlying foundation materials are generally considered stable. Properties and conditions of the soils typical of NTS have no limitation on construction. Soils would be affected by construction and operations of a proposed alternative.

None of the sites has known economically viable geologic resources that would be affected by the construction and operations of an alternative. Except for the potential existence of gold, tungsten, and molybdenum at NTS, geologic resources consist of surficial sand, gravel, or clay deposits that have low economic value. New construction may increase the use of the materials, but because large volumes of these materials are present, consequently the impact is anticipated to be negligible.

Construction of the proposed alternative facilities may involve ground-disturbing activities that could affect the soil resource. The amount of land disturbed is specified below for each alternative. Impacts would depend on the specific soil units in the disturbed area, the extent of the land disturbing activities, and the amount of soil disturbed. Within NTS, the soil erosion potential is directly related to the amount of land disturbed because soil and climatic conditions are similar throughout the site. Control measures would be employed during construction to minimize soil erosion.

Preferred Alternative: No Action Alternative

[Text deleted.]

Impacts to geologic and soil resources occur during, or as a result of, ground-disturbing construction activities. Under the No Action Alternative, DOE would continue current and ongoing activities at NTS. There would be no ground-disturbing activities beyond those associated with existing and future site improvements. Because new construction and the associated ground disturbance for potential soil erosion would not occur, the No Action Alternative would have no effect on the geologic or soil resources at the site.

Consolidation Alternative

Modify Existing Tunnel Drifts and Construct New Material Handling Building at the P-Tunnel

No apparent direct or indirect effects on the geologic resource are anticipated, because neither facility construction and operational activities nor site infrastructure improvements will restrict access to potential geologic resources. Design of the facilities would ensure that they would not be affected by potentially hazardous geological conditions.

[Text deleted.] Construction activities will occur completely on previously disturbed land, as described in Section 4.2.2.1 and involve land disturbance of approximately 29 ha (72 acres) that will affect the soil profile and potentially cause a temporary increase in soil erosion. Soil disturbance would occur primarily from ground-disturbing construction activities (foundation preparation) and activities associated with building construction laydown areas that can expose the soil profile and lead to a possible increase in soil erosion as a result of wind and water action. Soil loss would depend on the frequency and severity of rainstorm wind velocities (increased velocities and durations increase potential erosion); the frequency and severity of storms; and the size, location, and duration of ground-disturbing activities.

Net soil disturbance during operations would be considerably less than during construction because areas temporarily used for construction laydown would be restored. Although stormwater runoff and wind action could occur during operation, it is anticipated to be minimal. [Text deleted.]

Construct New Plutonium Storage Facility

Construction and operation effects on geologic resources for the storage facility are the same as those described for the modified P-Tunnel. However, additional soil impacts would be expected from the construction of the storage facility which will occur completely on previously disturbed land as described in Section 4.2.2.1. Approximately 58.5 ha (144 acres) would be disturbed for construction of the new facility, affecting the soil profile and leading to a possible temporary increase in soil erosion as a result of stormwater runoff and wind action. Soil losses would depend on frequency of storms, wind velocity, and location of the facility with respect to drainage and wind patterns; slope, shape, and area of the tracts of ground disturbed; and the duration of time the soil is bare. Soil impacts during operation are expected to be minimal.

Collocation Alternative

Modify Existing Tunnel Drifts and Construct New Material Handling Building at the P-Tunnel

Construction and operation effects on geological and soil resources for this alternative are the same as those discussed previously for the Consolidation Alternative using the modified P-Tunnel. Construction will occur completely on previously disturbed land, as described in Section 4.2.2.1, and involve land disturbance of approximately 29 ha (72 acres).

Construct New Plutonium and Highly Enriched Uranium Storage Facilities

[Text deleted.] Additional soil impacts would be anticipated from the construction of the storage facilities which will occur completely on previously undisturbed land, as described in Section 4.2.2.1. Approximately 89.5 ha (221 acres) would be disturbed for construction of the Collocation Alternative, affecting the soil profile and leading to a possible temporary increase in soil erosion as a result of storm water runoff and wind action. Soil losses would depend on frequency of storms, wind velocity, and location of the facility with respect to drainage and wind patterns; slope, shape, and area of the tracts of ground disturbed; and the duration of time the soil is exposed. Soil impacts during operation are expected to be minimal.

Subalternative Not Including Strategic Reserve and Weapons Research and Development Materials

Exclusion of strategic reserve and weapons R&D materials would give almost the same effects to the geologic and soil resources for the Consolidation Alternative and Collocation Alternative. By excluding these materials, the size of a facility would be similar, thus not changing the amount of land disturbed by construction activities. No effect to the geologic resource is anticipated as a result of this option. [Text deleted.]

[Text deleted.]

4.2.2.6 Biological Resources

Preferred Alternative: No Action Alternative

The missions described in Section 2.2.2 would continue at NTS. This would result in no changes to current conditions of biological resources at NTS as described in Section 3.3.6.

Consolidation Alternative

Consolidated storage facilities would be located in modified P-Tunnel drifts or in new facilities in the Frenchman Flat area.

Modify Existing Tunnel Drifts and Construct New Material Handling Building at the P-Tunnel

Terrestrial Resources. If consolidated storage facilities were located within the modified P-Tunnel area, existing and new facilities would be required at both the modified P-Tunnel site itself and the Area 12 Camp. Modification of existing structures would have minimal impact on terrestrial resources. New construction would also have minimal impact, because construction would take place within presently developed areas. The material handling facility, which is the principal structure to be built, would be located in an area on which excavated material from the modified P-Tunnel was deposited. Foundation preparation would require some additional soil, which would be imported from other as-yet-unspecified areas of NTS. If this material was excavated from a new borrow pit, terrestrial resources at the location could be affected. Construction and operation could result in disturbance to wildlife by noise and human activity, but impacts to wildlife would be minimal because animals would have already adjusted to ongoing activities.

Wetlands. Construction and operation of consolidated storage facilities would not affect wetlands since there are no wetlands in the vicinity of the modified P-Tunnel.

Aquatic Resources. Construction and operation of consolidated storage facilities would not affect aquatic resources since there are no permanent surface water bodies in the vicinity of the modified P-Tunnel.

Threatened and Endangered Species. Construction and operation of consolidated storage facilities would have minimal effect on threatened and endangered species in the modified P-Tunnel area since the habitat is already disturbed. The range of the federally listed threatened desert tortoise does not extend to the modified P-Tunnel area. Site surveys would be performed as necessary to determine the presence of special status species. Consultation with USFWS and State agencies would be conducted at the sit-specific levels, as appropriate.

Construct New Plutonium Storage Facility

Under this alternative, Pu would be consolidated in a new storage facility located in the Frenchman Flat area of NTS. Impacts to terrestrial resources, wetlands, aquatic resources, and threatened and endangered species are discussed below.

Terrestrial Resources. Construction of the consolidated Pu storage facility at NTS would result in the disturbance of 58.5 ha (144 acres) of terrestrial resources, or less than 0.02 percent of NTS. This includes areas on which facilities would be constructed, as well as areas used for construction laydown. Vegetative cover within the proposed project area, which is primarily creosote bush (Figure 3.3.6-1), would be destroyed during land-clearing operations. Creosote bush communities are well represented on NTS.

Construction of the Pu storage facility would affect animal populations. Less-mobile animals, such as reptiles and small mammals, within the project area would not be expected to survive. Construction activities and noise would cause larger mammals and birds in the construction and adjacent areas to move to similar habitat nearby.

If the area to which they moved was below its carrying capacity, these animals would be expected to survive. However, if the area was already supporting the maximum number of individuals, the additional animals would compete for limited resources, which could lead to habitat degradation and eventual loss of the excess population. Nests and young animals living within the proposed site may not survive. The site would be surveyed as necessary for the nests of migrating birds prior to construction. Areas disturbed by construction, but not occupied by facility structures, would be of minimal value to wildlife because of the difficulty in establishing vegetative cover in a desert environment.

Activities associated with operation, such as noise and human presence, could affect wildlife living immediately adjacent to the facility. These disturbances may cause some species to move from the area. Disturbance to wildlife living adjacent to the facility would be minimized by preventing workers from entering undisturbed areas. Impacts to vegetation from salt drift would not occur since dry cooling systems would be used.

Wetlands. Construction and operation of the Pu storage facility would not affect wetlands because there are no wetlands near the assumed facility location.

Aquatic Resources. Construction and operation of the Pu storage facility would not affect aquatic resources because there are no permanent surface water bodies near the assumed facility location.

Threatened and Endangered Species. The desert tortoise is a federally listed threatened species that could be affected by construction of the Pu storage facility at NTS. Construction activities such as land-clearing operations, trenches, and excavation could pose a threat to any tortoises residing within the disturbed area. An increase in vehicular traffic is an additional hazard to the tortoise. Measures from previous projects at NTS designed to avoid impacts to the desert tortoise have been implemented as a result of a Biological Opinion issued by the USFWS (NT DOI 1992b:8-15). Recommended mitigation measures included providing worker training; putting restrictions on vehicle speeds and off-road movement; conducting clearance surveys prior to surface disturbance; approving stop work authority if tortoises are found within work areas; removing tortoises from roadways and work areas; placing permanent and temporary tortoise-proof fencing around trenches, landfills, and treatment ponds; inspecting trenches; and having biologists present when heavy equipment is in use. The USFWS would be consulted, and similar USFWS recommendations would be implemented should NTS be selected as the location for the Pu storage facility.

[Text deleted.] Any listed plant species located within the construction area could be lost or affected during land-clearing activities. Preactivity surveys would be conducted as appropriate prior to construction to determine the presence of these species in the area to be disturbed. Consultation with USFWS and State agencies would be conducted at the site-specific levels, as appropriate.

During facility operation, vehicular traffic would pose a hazard to the desert tortoise similar to the hazard caused by current traffic. Extensive measures, including personnel training, are presently being taken to ensure that drivers on NTS avoid the tortoise. [Text deleted.] Groundwater levels in Devils Hole are not expected to change due to operation of the Pu storage facility (Section 4.2.2.4), so impacts to the Devils Hole pupfish are not expected. Similarly, other rare endemic aquatic species found in the Ash Meadows area would not be affected.

Collocation Alternative

Under this alternative, consolidated Pu would be stored with HEU inventories in existing and new facilities in the modified P-Tunnel area or in a new collocated Pu storage facility sited at the same location as the consolidated storage facility.

Modify Existing Tunnel Drifts and Construct New Material Handling Building at the P-Tunnel

Impacts to biological resources from placing collocated storage facilities in modified P-Tunnel drifts would be similar to those described previously for consolidated storage facilities. This is because both facilities are of a similar size and both would be placed within developed portions of the P-Tunnel site and Area 12 Camp.

Construct New Plutonium and Highly Enriched Uranium Storage Facilities

Construction and operation of a collocated storage facility at the Frenchman Flat area of NTS would have similar, but somewhat greater effects on biological resources as those described for the consolidated storage facility. Construction of the collocated storage alternative would disturb 89.5 ha (221 acres) of habitat.

Subalternative Not Including Strategic Reserve and Weapons Research and Development Materials

The exclusion of strategic reserve and weapons R&D materials would have almost the same effects to the Consolidation Alternative and the Collocation Alternative. The size of facility would be similar and would not result in the reduction of disturbed habitat and/or fewer facility modifications and thus lessen the potential impacts to biological resources would be similar. [Text deleted.]

4.2.2.7 Cultural and Paleontological Resources

Preferred Alternative: No Action Alternative

Under this alternative, DOE would continue the existing and planned missions at NTS. Management of NTS's cultural resources follows the Programmatic Agreement between DOE, the Nevada SHPO, and the Advisory Council on Historic Preservation. Any impacts to cultural or paleontological resources from these missions would be independent of the proposed action and would be addressed through separate NHPA, *American Indian Religious Freedom Act*, and *Native American Graves Protection and Repatriation Act* regulatory compliance procedures.

Consolidation Alternative

Modify Existing Tunnel Drifts and Construct New Material Handling Building at the P-Tunnel

The existing P-Tunnel is located in Area 12. Modification would result in ground disturbance of 29 ha (72 acres) on previously disturbed land. No new, undisturbed land would be used. The P-Tunnel is on Rainier Mesa, in Area 12. In 1990, DOE entered into a Programmatic Agreement with the Nevada SHPO and the Advisory Council on Historic Preservation that has resulted in an in-depth cultural resources study of 11 percent of Pahute and Rainier Mesas. Additional surveys would be completed prior to construction on any currently unexamined tracts. This area is rich in cultural resources, including many archaeological sites. Construction of the proposed facility may affect some potentially NRHP-eligible resources. Recorded prehistoric sites in the area include quarries, lithic workshops, campsites, and rock shelters. Historic site types include remains of ranches and mines. Operation would not have an additional impact on prehistoric or historic resources. Some paleontological resources may also be affected by land disturbance during construction. Operation would not result in additional impacts to those resources.

The CGTO is an alliance of Native American groups that have ties to the land at NTS. This alliance has in the past requested and been denied access to Rainier Mesa. Consequently, no important Native American resources have been identified there to date. Oral histories indicate that some resources, such as ancestral campsites, are located within Rainier Mesa (NT DOE 1996c:4-169). Additional Native American resources such as archaeological sites, traditionally used plant and animal species, and rock art may be affected by both the construction and operation of the proposed facility. Consultation with interested parties during the *American Indian Religious Freedom Act*, *Native American Graves Protection and Repatriation Act*, and NHPA compliance process may identify some of these resources.

Construct New Plutonium Storage Facility

The new Pu storage facility would be situated in the northern portion of Frenchman Flat in Area 6, near the DAF. The operational land requirement for the proposed facility is 56 ha (138 acres). Some new construction would be necessary. Land to be disturbed during construction totals 58.5 ha (144 acres). A 1.6-km (1-mi) reduced-access buffer zone would be created around the facility.

[Text deleted.] In 1984, a Class III cultural resources survey was conducted across the 660-ha (1,610-acres) DAF site and no NRHP-eligible sites were identified. Although no resources were identified within the DAF project area, Frenchman Flat contains 49 sites that have been determined eligible for inclusion on the NRHP. Recorded prehistoric sites within Frenchman Flat include base and temporary camps, quarries, and lithic reduction areas. Identified historic resources include sites associated with nuclear testing and research. Additional unsurveyed lands necessary for the proposed facility may contain similar prehistoric or historic resources.

Impacts to resources could occur during construction of the proposed facility. Operation would not result in additional impact as it does not involve ground disturbance or increased activity. In addition, construction (but not operation) may have some impact on Late Pleistocene paleontological resources, should any exist within the acreage to be disturbed.

The CGTO has conducted surveys over portions of Frenchman Flat. The area is known to contain at least 20 plant species of importance to Native Americans. Additional project-specific consultations would be necessary to identify impacts to Native American resources resulting from the construction and operation of the proposed facility. Potential impacts include reduced access to traditional use areas and visual or auditory intrusions to sacred space.

Collocation Alternative

Modify Existing Tunnel Drifts and Construct New Material Handling Building at the P-Tunnel

Potential impacts under this option would be the same as the P-Tunnel discussion under the Consolidation Alternative.

Construct New Plutonium and Highly Enriched Uranium Storage Facilities

Construction of the proposed Pu and HEU storage facility would disturb 89.5 ha (221 acres) of land; operation would require 87 ha (215 acres). A 1.6-km (1-mi) reduced-access buffer zone would be created around the facility. The proposed location is contained within Area 6 near the DAF. Impacts to cultural and paleontological resources would be similar to those discussed under the new storage facility option of the Consolidation Alternative.

Subalternative Not Including Strategic Reserve and Weapons Research and Development Materials

Under this subalternative, facility and other resource requirements will be almost the same as the Consolidation and Collocation Alternative. Therefore, impacts to cultural and paleontological resources would equal those previously discussed. [Text deleted.]

4.2.2.8 Socioeconomics

Preferred Alternative: No Action Alternative

Under this alternative, the existing storage facility would remain operational. No new employment or immigration of workers would be required.

Regional Economy Characteristics. Total employment in the REA is projected to grow 3.4 percent annually between 1995 and 2000, reaching 686,800 in the latter year. Slower growth is projected after the year 2000, when employment will increase 2 percent annually and reach approximately 1,236,600 in 2040. Unemployment in the REA was 6.1 percent in 1994 and is expected to remain at this level into the near future. Per capita income is projected to increase from approximately \$21,900 in 1995 to \$46,134 in 2040. No Action projections are presented in Table L.1–19.

Population and Housing. Population in the ROI is projected to total 990,700 in 1995 and reach 2,087,000 by 2040. Over the same period, the total number of housing units in the ROI is projected to increase from 403,700 to 850,500. No Action projections for population and housing are presented in Tables L.1–20 and L.1–21, respectively.

Community Services. Education, public safety, and health care characteristics are used to assess the level of community services in the NTS ROI. School enrollments are projected to increase from approximately 165,630 students in 1995 to 348,920 students by 2040. In 1994, the student-to-teacher ratio was 19.6:1. To maintain this level of service, the number of teachers in the ROI would need to increase from 8,466 in 1995 to 17,833 in 2040. No Action projections are presented in Tables L.1–22 and L.1–23.

The projected number of sworn police officers and firefighters serving ROI communities during the period 1995 to 2040 is shown in Tables L.1–24 and L.1–25, respectively. Under No Action, the number of sworn police officers is projected to increase from 1,946 in 1995 to 4,101 in 2040 to maintain the current service level of 2.0 officers per 1,000 persons. The number of firefighters in the ROI is estimated to increase from 1,553 in 1995 to 3,271 in 2040 to maintain the current service level of 1.6 firefighters per 1,000 persons.

Hospital occupancy rates are based on current capacity. Projections of hospital occupancy rates and the number of practicing physicians serving the ROI population between 1995 and 2040 are presented in Tables L.1–26 and L.1–27, respectively. Without expansion of existing capacity, hospital occupancy rates for the ROI would increase from 62 percent in 1995 to over 100 percent in 2040. If the 1994 physician-to-population ratio of 1.3 physicians per 1,000 persons is to be maintained, the total number of physicians would need to increase from 1,276 in 1995 to 2,704 in 2040.

Local Transportation. The worker population at NTS would not increase and could decrease. Any increases in traffic would be due to the projected growth in the area unrelated to DOE activities. [Text deleted.]

Consolidation Alternative

Modify Existing Tunnel Drifts and Construct New Material Handling Building at the P-Tunnel

Modification of the existing P-Tunnel at NTS to consolidate the storage of Pu would require 1,103 workers during the peak construction year and would generate over 2,100 jobs (direct and indirect) in the region. Operation of the facility would generate over 1,400 jobs (direct and indirect) in the region. Projections indicate that there would be sufficient labor available within the region to fill all direct and indirect jobs during both construction and operations.

Regional Economy Characteristics. A total of 2,139 (1,103 direct and 1,036 indirect) jobs would be created in the region during the construction of the facility. Employment in the region would increase by less than 1 percent, and the unemployment rate would fall from the No Action projection of 6.1 percent to 5.8 percent. Per capita income would increase by less than 1 percent (Socio 1996a).

Operation of the facility would generate a total of 1,406 jobs (527 direct and 879 indirect) in the region, increasing regional employment by less than 1 percent. Operation workers would begin phasing in as construction nears completion. Unemployment would rise from 5.8 percent during peak construction to 5.9 percent during operation but remain below the No Action level of 6.1 percent (Socio 1996a).

Population, Housing, and Community Services. All newly created jobs would be filled by the resident labor force. Therefore, there would be no change to the region's population from the No Action projections. Accordingly, there would be minimal impacts to the demand for housing or community services in the region as a result of the construction and operation of this facility (Socio 1996a).

Local Transportation. During the peak construction year, workers would generate 2,118 vehicle trips per day. During operations, workers would generate 1,012 vehicle trips per day. These increases would not affect the level of service on the local road segments analyzed (Socio 1996a).

Construct New Plutonium Storage Facility

Construction of a new facility for the consolidated storage of Pu at NTS would generate over 2,100 jobs (direct and indirect) within the REA. Operation would generate over 1,300 jobs (direct and indirect) in the region. Projections indicate that there would be sufficient available labor in the region to fill all of the direct and indirect jobs. [Text deleted.]

[Text deleted.]

Regional Economy Characteristics. During the construction period, the project would add a total of 2,122 (1,094 direct and 1,028 indirect) jobs to the regional economy that would be filled by the labor available within the region. The regional unemployment rate would decrease from 6.1 percent to 5.8 percent, while per capita income would increase minimally (much less than 1 percent) (Socio 1996a).

The consolidated storage facility at NTS would create 1,313 jobs (492 direct and 821 indirect) during full operation, increasing total employment in the REA by much less than 1 percent over the No Action projection. Available labor would fill all of the indirect positions. However, some workers would need to in-migrate to fill specialized direct employment requirements. Operation workers would begin phasing in as construction nears completion. Unemployment would rise from 5.8 percent during peak construction to 6.0 percent during operation but would remain below the No Action level of 6.1 percent. Per capita income would increase minimally (much less than 1 percent) (Socio 1996a).

Population, Housing, and Community Services. All newly created jobs would be filled by the resident labor force. Therefore, there would be no change to the region's population from the No Action projections. Accordingly, there would be minimal impact to the demand for housing or community services in the region as a result of the construction and operation of this facility. [Text deleted.]

[Text deleted.]

Local Transportation. Construction workers would generate a projected 2,100 vehicle trips per day during peak construction activity. During operations, workers would generate 945 vehicle trips per day. These increases would not affect the level of service on the local road segments analyzed (Socio 1996a).

Collocation Alternative

Modify Existing Tunnel Drifts and Construct New Material Handling Building at the P-Tunnel

Modification of the existing P-Tunnel at NTS to consolidate the storage of all Pu and HEU would generate a total of over 2,500 jobs (direct and indirect) during the construction phase. Projections indicate that there would be sufficient labor available within the region to fill these positions. However, operations of the upgraded facility, which would generate over 1,700 total jobs (direct and indirect), would require some workers to relocate to the area to fill specialized employment requirements. Available labor within the REA would fill all of the indirect jobs created during the operation phase. The impacts on the region's economy, population, housing, community services, and local transportation are discussed below.

Regional Economy Characteristics. Modification of the existing P-Tunnel would require 1,297 workers during the peak construction year and would generate an additional 1,218 jobs in other industries within the REA. The available labor force within the region would be sufficient to fill all the direct and indirect jobs created. Employment in the REA would increase by less than 1 percent over No Action, and the unemployment rate would fall from the No Action projection of 6.1 percent to 5.8 percent. Per capita income would increase by less than 1 percent (Socio 1996a).

Operation of the facility would require 641 new employees and would generate an additional 1,069 indirect jobs within the REA. Available labor within the REA would fill all of the indirect positions, however, some workers would have to in-migrate to fill specialized direct employment requirements. Total employment and per capita income in the region would both increase by much less than 1 percent over No Action projections. Operation workers would begin phasing in as construction nears completion. Unemployment would rise from 5.8 percent during peak construction to 5.9 percent during operation but would remain below the No Action level of 6.1 percent (Socio 1996a).

Population and Housing. During full operation of the upgraded facility, in-migration is projected to increase population in the ROI by 73 over the No Action Alternative, a change of much less than 1 percent of total population. Projected vacancies in the housing stock would be sufficient to accommodate the slight increase in demand (Socio 1996a).

Community Services. Because there would be no in-migration associated with construction of the upgraded facility, and the population change resulting from operations is so small, the demand for community services would remain unchanged from No Action projections (Socio 1996a). [Text deleted.]

[Text deleted.]

Local Transportation. Construction workers would generate a projected 2,490 vehicle trips per day in the year 2001 (the peak construction year) under this alternative. Operation workers would generate 1,231 vehicle trips per day. These increases would not affect the level of service on the local road segments analyzed (Socio 1996a).

Construct New Plutonium and Highly Enriched Uranium Storage Facilities

Construction of a new facility to store all Pu and HEU would generate almost 2,200 jobs (direct and indirect) in the region. Operation of the facility would generate over 1,600 jobs. Projections indicate that workers would in-migrate to the REA to fill some of the direct jobs created during the operation of a new consolidated Pu and HEU storage facility at NTS. However, there would be sufficient available labor in the REA to fill both the

indirect jobs created during operation and all employment generated by the construction of the facility. The effects on the region's economy, population, housing, community services, and local transportation are discussed below.

Regional Economy Characteristics. Construction of the new consolidated Pu and HEU storage facility would generate 1,123 direct and 1,055 indirect jobs during peak construction at NTS. Total employment in the region would increase by less than 1 percent, and the unemployment rate would decrease from the No Action projection of 6.1 percent to 5.8 percent. Per capita income would increase by much less than 1 percent (Socio 1996a).

Operation of the proposed storage facilities would generate a total of 1,659 new jobs (622 direct and 1,037 indirect) in the REA, with some direct jobs filled by in-migrant workers. All of the indirect positions would be filled by available labor in the REA. Total employment in the region would increase by less than 1 percent over the No Action projection. Operation workers would begin phasing in as construction nears completion. Unemployment would rise from 5.8 percent during peak construction to 5.9 percent during operation but remain below the No Action level of 6.1 percent. Per capita income would increase much less than 1 percent (Socio 1996a).

Population and Housing. Although 22 workers would in-migrate to the REA during the operation phase of the proposed storage facilities, the resulting change to population would be less than a 1 percent increase over No Action. Projected housing vacancies would be sufficient to accommodate demand from the in-migrating population (Socio 1996a).

Community Services. Because there would be no in-migration associated with construction of the facility, and the population change from operations is so small, the demand for community services would remain unchanged from No Action projections (Socio 1996a).

[Text deleted.]

Local Transportation. Construction employees would generate 2,156 vehicle trips per day. Operation employees would generate an estimated 1,194 vehicle trips per day. These increases would not affect the level of service on the local road segments analyzed (Socio 1996a).

Subalternative Not Including Strategic Reserve and Weapons Research and Development Materials

If strategic reserve and weapons R&D materials are not included in the storage requirements at NTS, there would be a small reduction in worker requirements for construction and operation of the facility. Therefore, the socioeconomic effects would be less than those options including strategic reserve and weapons R&D for the Consolidation Alternative and the Collocation Alternative. [Text deleted.]

4.2.2.9 Public and Occupational Health and Safety

The assessments of potential radiological and chemical impacts associated with the storage alternatives at NTS are presented in this section. Summaries of radiological impacts from normal operations are presented in Tables 4.2.2.9-1 and 4.2.2.9-2 for the public and workers, respectively. Impacts from hazardous chemicals are presented in Table 4.2.2.9-3. Summaries of impacts associated with postulated accidents are given in Tables 4.2.2.9-4 through 4.2.2.9-7. Detailed results are presented in Appendix M.

Preferred Alternative: No Action Alternative

This section describes the radiological and hazardous chemical releases and their associated impacts resulting from normal operations involved with the sitewide NTS missions. The radiological and chemical source terms (releases) under the No Action Alternative are taken to be the same as for the existing baseline condition; the resulting impacts would be within applicable regulatory limits. For facility accidents, the risks and consequences are described in site safety documentation.

Normal Operation. The doses and potential health effects on the public and workers during normal operations are described below.

Radiological Impacts. The calculated annual dose to the average and maximally exposed members of the public from total site operation; the associated fatal cancer risks to these individuals from 50 years of operation; the dose to the population within 80 km (50 mi) from total site operation in the year 2030; and the projected number of fatal cancers in this population from 50 years of operation are presented in Table 4.2.2.9-1 under this alternative at NTS. The annual dose of 4.2×10^{-3} mrem to the MEI is within the radiological limits specified in NESHAPS (40 CFR 61, Subpart H) and DOE Order 5400.5. From 50 years of operation, the corresponding risk of fatal cancer to this individual would be 1.0×10^{-7} . This activity would be included in a program to ensure that doses to the public are ALARA. The annual dose of 3.7×10^{-3} person-rem to the population would be within the limit in proposed 10 CFR 834. The corresponding number of fatal cancers in this population from 50 years of operation would be 9.3×10^{-5} . To put operational doses into perspective, comparisons with doses from natural background radiation are included in the table.

Under the No Action Alternative, as shown in Table 4.2.2.9-2, the annual average dose to a noninvolved (No Action) site worker and the annual dose to the noninvolved (No Action) total site workforce would be 5.0 mrem and 3.0 person-rem, respectively. The associated risk of fatal cancer to the average worker from 50 years of total site operations would be 1.0×10^{-4} and the projected number of fatal cancers among all workers from 50 years of total site operations would be 0.060.

Hazardous Chemical Impacts. There would be no hazardous chemical impacts shown in Table 4.2.2.9-3 on the public or to workers resulting from the normal operation under No Action at NTS because no hazardous or other carcinogens are released.

Facility Accidents. Under the No Action Alternative, facilities would continue to operate in accordance with DOE safety orders, which ensure that the risk to the public of prompt fatalities due to accidents or cancer fatalities due to operations will be minimized. The safety to workers and the public from accidents at existing facilities is also controlled by Technical Safety Requirements specified in detail in SARs or a Basis for Interim Operations document prepared and maintained specifically for a facility or process within a facility. Under these controls, any change in approved operations or to facilities would cause a halt in operations until it can be established that worker and public safety has not been compromised.

Earthquakes offer the greatest threat from natural phenomena. Available seismology studies indicate that active faults such as the Mine Mountain Fault, the Carpetbag Fault, the Yucca Flat Fault, and the Cane Spring Fault in the NTS vicinity are capable of generating earthquakes of up to 0.85 g (PX DOE 1996b:5-16). NTS has a natural background seismicity. The Cane Springs Fault, located 5 to 8 km (3 to 5 mi) south-southeast of the DAF area, has been identified as the most significant feature from the standpoint of seismic risk. However, a large portion of seismic events occurring near NTS may have been aftershocks from past nuclear explosions. The proposed storage area in P-Tunnel is only a few hundred feet away from the site of some past nuclear explosions. Since the P-Tunnel has survived these explosions without noticeable degradation, it is not reasonably foreseeable that the proposed storage area would be damaged by an earthquake. However, if the P-Tunnel collapses, the impact forces could breach some containers. The collapse would also seal the containers inside the tunnel, resulting in no or minimal short-term releases to the environment. Thus, the consequences to the public and workers are considered negligible.

Consolidation Alternative

This section includes a description of radiological and hazardous chemical releases and their associated impacts resulting from either normal operation or accidents involved with the new material handling building and modified P-Tunnel drifts and with the new consolidated Pu storage facility at NTS.

Normal operation under either consolidated storage option would result in impacts that are within applicable regulatory limits.

[Text deleted.]

Modify Existing Tunnel Drifts and Construct New Material Handling Building at the P-Tunnel

Normal Operation. There would be no radiological releases during the construction of a new material handling building or from modifying P-Tunnel drifts at NTS. Construction worker exposures to material potentially contaminated with radioactivity (for example, from construction activities involved with existing contaminated soil) would be limited to assure that doses are maintained ALARA. Toward this end, construction workers would be monitored as appropriate. Limited hazardous chemical releases are anticipated as a result of construction activities. However, concentrations would be within the regulated exposure limits. During normal operation, there would be both radiological and hazardous chemical releases to the environment as well as direct in-plant exposures. The resulting doses and potential health effects to the public and workers at NTS are described below.

Radiological Impacts. The radiological impacts to the public resulting from the normal operation of the modified P-Tunnel and the associated handling building are given in Table 4.2.2.9-1. The dose to the MEI due to annual storage operation in the P-Tunnel drifts and handling building would be 5.6×10^{-6} mrem. From 50 years of operation, the corresponding risk of fatal cancer to this individual would be 1.4×10^{-10} . The impacts to the average individual would be less. As a result of storage operations in the year 2030, the population dose would be 1.7×10^{-6} person-rem. The corresponding number of fatal cancers in this population due to 50 years of operation would be 4.3×10^{-8} .

The dose to the MEI of the public due to annual total site operations is within the radiological limits specified in NESHAPS (40 CFR 61, Subpart H) and DOE Order 5400.5, and would be 4.2×10^{-3} mrem. From 50 years of operation, the corresponding risk of fatal cancer to this individual would be 1.0×10^{-7} . The impacts to the average individual would be less. This activity would be included in a program to ensure that doses to the public are ALARA. As a result of total site operation in the year 2030, the population doses would all be within the limit in proposed 10 CFR 834 and would be 3.7×10^{-3} person-rem. The corresponding number of fatal cancers in this population due to 50 years of operation would be 9.3×10^{-5} .

Doses to onsite workers due to normal operations are given in Table 4.2.2.9–2. Included are involved workers directly associated with the new handling building and modified P-Tunnel drifts, workers who are not involved with the new building and modified P-Tunnel drifts, and the entire workforce at NTS. All doses fall within regulatory limits and administrative control levels. The associated risks and numbers of fatal cancers among the different workers from 50 years of operation are included in the table. For the purposes of analyses only, this PEIS assumes that TRU and TRU mixed waste would be treated onsite to the current planning-basis WIPP WAC, and shipped to WIPP for disposal. This PEIS also assumes that LLW and mixed LLW would be treated and disposed of in accordance with current site practice. Also, this analysis assumes that hazardous waste would be treated and disposed of in accordance with current site practice.

Hazardous Chemical Impacts. Hazardous chemical impacts to the public and to the onsite worker resulting from the normal operations of consolidated storage in the P-Tunnel facility and the new handling building at NTS are presented in Table 4.2.2.9–3. The impacts from all site operations, including the upgraded storage facilities, are also included in this table. Total site impacts, which include the No Action impact plus the facility impact, are provided. All analyses to support the values presented in this table are provided in Section M.3.

The HI to the MEI of the public is 2.5×10^{-6} , and the cancer risk is 4.1×10^{-9} as a result of operation of consolidated storage in the P-Tunnel facility and handling building in the year 2030. The total HI and cancer risk from hazardous chemicals would remain constant over 50 years of operation, provided exposures remain the same. The total site operation, including the consolidated facility, would result in an HI of 2.5×10^{-6} and a cancer risk of 4.1×10^{-9} for the MEI in the year 2030. This would be expected to remain constant as a result of 50 years of operation.

The HI to the onsite worker at P-Tunnel is 5.1×10^{-4} , and the cancer risk is 6.4×10^{-6} as a result of operation of consolidated storage in the year 2030. The total HI and cancer risk would remain constant over 50 years of operation, provided exposures remain the same. The total operation, including the consolidated facility, would result in an HI of 5.1×10^{-4} and a cancer risk of 6.4×10^{-6} for the onsite worker. This would be expected to remain constant as a result of 50 years of operation.

Facility Accidents. A set of potential accidents for modified P-Tunnel drifts for which there may be releases of Pu that may impact onsite workers and the offsite population has been postulated for the P-Tunnel. The accident consequences and risks to a worker located 1,000 m (3,280 ft) from the accident release point, the maximum offsite individual located at the site boundary, and the population located within 80 km (50 mi) of the accident release point are summarized in Table 4.2.2.9–4. For the set of accidents analyzed, the maximum number of cancer fatalities in the population within 80 km (50 mi) would be 5.3×10^{-4} at NTS for the truck bay fire accident scenario with a probability of 1.0×10^{-7} per year. The corresponding 50-year facility lifetime risk from the same accident scenario for the population, maximum offsite individual, and worker at 1,000 m (3,280 ft), would be 2.7×10^{-9} , 3.6×10^{-10} , and 2.1×10^{-9} , respectively. The maximum population 50-year facility lifetime risk would be 5.1×10^{-5} (that is, one fatality in about 1,000,000 years) at NTS for the PCV Penetration by Corrosion accident scenario with a probability of 0.064 per year. The corresponding maximum offsite individual and worker 50-year facility lifetime risks would be 6.9×10^{-6} and 4.0×10^{-5} , respectively. Section M.5 presents additional facility accident data and summary descriptions of the accident scenarios identified in Table 4.2.2.9–4.

Involved workers, those that would work in the facilities associated with the proposed action, may be subject to injury and, in some cases, fatality as a result of potential accidents. The locations of workstations, number of workers, personnel protective features, engineered safety features, and other design details affect the extent of worker exposures to accidents. Certain accidents such as fires, explosions and criticality could cause fatalities to workers close to the accident. Prior to construction of a new or modification of an existing facility, DOE Orders require detailed safety analyses to assure that facility designs and operating procedures limit the number of workers in hazardous areas and minimize risk of injury or fatality in the event of an accident.

Involved workers, those that would work in the facilities associated with the proposed action, may be subject to injury and, in some cases, fatality as a result of potential accidents. The locations of workstations, number of workers, personnel protective features, engineered safety features, and other design details affect the extent of worker exposures to accidents. Certain accidents such as fires, explosions and criticality could cause fatalities to workers close to the accident. Prior to construction of a new or modification of an existing facility, DOE Orders require detailed safety analyses to assure that facility designs and operating procedures limit the number of workers in hazardous areas and minimize risk of injury or fatality in the event of an accident.

Construct New Plutonium Storage Facility

Normal Operation. There would be no radiological releases during the construction of a new consolidated Pu storage facility at NTS. Construction worker exposures to material potentially contaminated with radioactivity (for example, from construction activities involved with existing contaminated soil) would be limited to assure that doses are maintained ALARA. Toward this end, construction workers would be monitored as appropriate. Limited hazardous chemical releases are anticipated as a result of construction activities. However, concentrations would be within the regulated exposure limits. During normal operation, there would be both radiological and hazardous chemical releases to the environment as well as direct in-plant exposures. The resulting doses and potential health effects on the public and workers at NTS are described below.

Radiological Impacts. Radiological impacts to the public resulting from the normal operation of the new consolidated Pu storage facility are presented in Table 4.2.2.9–1. The impacts from all site operations, including the new consolidated storage facility, are also given in the table. To put operational doses into perspective, comparisons with natural background radiation doses are included in the table.

The dose to the MEI due to annual storage facility operation would be 1.3×10^{-6} mrem. From 50 years of operation, the corresponding risk of fatal cancer to this individual would be 3.2×10^{-11} . The impacts to the average individual would be less. As a result of storage facility operation in the year 2030, the population dose would be 2.6×10^{-6} person-rem. The corresponding number of fatal cancers in this population due to 50 years of operation would be 6.5×10^{-8} .

The dose to the MEI due to annual total site operations is within the radiological limits specified in NESHAPS (40 CFR 61, Subpart H) and DOE Order 5400.5, and would be 4.2×10^{-3} mrem. From 50 years of operation, the corresponding risk of fatal cancer to this individual would be 1.0×10^{-7} . The impacts to the average individual would be less. This activity would be included in a program to ensure that doses to the public are ALARA. As a result of total site operation in the year 2030, the population dose would be within the limit in proposed 10 CFR 834 and would be 3.7×10^{-3} person-rem. The corresponding number of fatal cancers in this population due to 50 years of operation would be 9.3×10^{-5} .

Doses to onsite workers from normal operations are given in Table 4.2.2.9–2. Included are involved workers directly associated with the new consolidated Pu storage facility, workers who are not involved with the storage facility, and the entire workforce at NTS. All doses fall within regulatory limits and administrative control levels. The associated risks and numbers of fatal cancers among the different workers from 50 years of operations are included in the table.

Hazardous Chemical Impacts. Hazardous chemical impacts to the public and to the onsite worker resulting from the normal operations of the consolidated storage facilities at NTS are presented in Table 4.2.2.9–3. The impacts from all site operations, including the new consolidated storage facilities are also included in this table. Total site impacts, which include the No Action impact plus the facility are provided. All analyses to support the values presented in this table are provided in Section M.3.

The HI to the MEI of the public is 2.3×10^{-6} , and the cancer risk is 4.1×10^{-9} as a result of operation of the consolidated storage facilities in the year 2030. The HI and cancer risk from hazardous chemicals would remain

constant over 50 years of operation, because exposures would be expected to remain the same. The total site operation, including the consolidated facility, would result in an HI of 2.3×10^{-6} and a cancer risk of 4.1×10^{-9} for the MEI in the year 2030. This would be expected to remain constant as a result of 50 years of operation.

The HI to the onsite worker would be 4.7×10^{-4} , and the cancer risk is 6.4×10^{-6} as a result of operation of the consolidated storage facilities in the year 2030. The HI and cancer risk would remain constant over 50 years of operation, because exposures would be expected to remain the same. The total site operation, including the consolidated facility, would result in an HI of 4.7×10^{-4} and a cancer risk of 6.4×10^{-6} for the onsite worker in the year 2030. This would be expected to remain constant as a result of 50 years of operation.

Facility Accidents. A set of potential accidents for consolidation of Pu in a new storage facility for which there may be releases of Pu that may impact onsite workers and the offsite population has been postulated. The accident consequences and risks to a worker located 1,000 m (3,280 ft) from the accident release point, the maximum offsite individual located at the site boundary, and the population located within 80 km (50 mi) of the accident release point are summarized in Table 4.2.2.9–5. For the set of accidents analyzed, the maximum number of cancer fatalities in the population within 80 km (50 mi) would be 0.027 at NTS for the beyond design basis earthquake accident scenario with an estimated probability of 1.0×10^{-7} per year (that is, probability of severe earthquake occurring is estimated to be about 1.0×10^{-5} , once in 100,000 years, multiplied by a damage and release probability of 0.01). The corresponding 50-year facility lifetime risk from the same accident scenario for the population, maximum offsite individual, and worker at 1,000 m (3,280 ft), would be 1.4×10^{-7} , 1.3×10^{-9} , and 7.3×10^{-8} , respectively. The maximum population 50-year facility lifetime risk would be 9.4×10^{-5} (that is, one fatality in about 540,000 years) at NTS for the PCV penetration by corrosion accident scenario with a probability of 0.064 per year. The corresponding maximum offsite individual and worker 50-year facility lifetime risks would be 9.1×10^{-7} and 3.9×10^{-5} , respectively. Section M.5 presents additional facility accident data and summary descriptions of the accident scenarios identified in Table 4.2.2.9–5.

Involved workers, those that would work in the facilities associated with the proposed action, may be subject to injury and, in some cases, fatality as a result of potential accidents. The locations of workstations, number of workers, personnel protective features, engineered safety features, and other design details affect the extent of worker exposures to accidents. Certain accidents such as fires, explosions and criticality could cause fatalities to workers close to the accident. Prior to construction of a new or modification of an existing facility, DOE Orders require detailed safety analyses to assure that facility designs and operating procedures limit the number of workers in hazardous areas and minimize risk of injury or fatality in the event of an accident.

Collocation Alternative

This section includes a description of radiological and hazardous chemical releases and the associated impacts resulting from either normal operation or accidents involved with the consolidation of Pu storage and collocation with HEU storage facilities at NTS. This storage would take place in either the modified P-Tunnel drifts or in a new collocated Pu and HEU storage facility.

Normal operation under either the modified P-Tunnel option or the new collocated storage facility option at NTS would result in impacts that are within applicable regulatory limits.

Involved workers, those that would work in the facilities associated with the proposed action, may be subject to injury and, in some cases, fatality as a result of potential accidents. [Text deleted.] The locations of workstations, number of workers, personnel protective features, engineered safety features, and other design details affect the extent of worker exposures to accidents. Certain accidents such as fires, explosions and criticality could cause fatalities to workers close to the accident. Prior to construction of a new or modification of an existing facility, DOE Orders require detailed safety analyses to assure that facility designs and operating procedures limit the number of workers in hazardous areas and minimize risk of injury or fatality in the event of an accident.

Table 4.2.2.9–5. Consolidation Alternative (New Storage Facility) Accident Impacts at Nevada Test Site

Accident Description	Worker at 1,000 m		Maximum Offsite Individual		Population to 80 km		Accident Frequency (per yr)
	Risk of Cancer Fatality (per 50 yr) ^a	Probability of Cancer Fatality ^b	Risk of Cancer Fatality (per 50 yr) ^a	Probability of Cancer Fatality ^b	Risk of Cancer Fatalities (per 50 yr) ^a	Number of Cancer Fatalities ^c	
PCV puncture by forklift	9.0x10 ⁻⁸	3.0x10 ⁻⁶	2.1x10 ⁻⁹	7.0x10 ⁻⁸	2.2x10 ⁻⁷	7.2x10 ⁻⁶	6.0x10 ⁻⁴
PCV breach by firearms discharge	5.3x10 ⁻⁹	3.0x10 ⁻⁷	1.2x10 ⁻¹⁰	7.0x10 ⁻⁹	1.3x10 ⁻⁸	7.2x10 ⁻⁷	3.5x10 ⁻⁴
PCV penetration by corrosion	3.9x10 ⁻⁵	1.2x10 ⁻⁵	9.1x10 ⁻⁷	2.9x10 ⁻⁷	9.4x10 ⁻⁵	3.0x10 ⁻⁵	0.064
Vault fire	3.8x10 ⁻⁸	7.6x10 ⁻³	7.3x10 ⁻¹⁰	1.5x10 ⁻⁴	7.6x10 ⁻⁸	0.015	1.0x10 ⁻⁷
Truck bay fire	2.1x10 ⁻⁹	4.2x10 ⁻⁴	4.9x10 ⁻¹¹	9.7x10 ⁻⁶	5.1x10 ⁻⁹	1.0x10 ⁻³	1.0x10 ⁻⁷
Spontaneous combustion	2.1x10 ⁻¹¹	6.0x10 ⁻⁷	4.9x10 ⁻¹³	1.4x10 ⁻⁸	5.1x10 ⁻¹¹	1.5x10 ⁻⁶	7.0x10 ⁻⁷
Explosion in the vault	4.9x10 ⁻⁹	9.9x10 ⁻⁴	1.1x10 ⁻¹⁰	2.3x10 ⁻⁵	1.2x10 ⁻⁸	2.4x10 ⁻³	1.0x10 ⁻⁷
Explosion outside of vault	2.3x10 ⁻¹¹	4.5x10 ⁻⁶	5.2x10 ⁻¹³	1.0x10 ⁻⁷	5.4x10 ⁻¹¹	1.1x10 ⁻⁵	1.0x10 ⁻⁷
Nuclear criticality	1.5x10 ⁻¹¹	3.1x10 ⁻⁶	3.3x10 ⁻¹³	6.5x10 ⁻⁸	3.5x10 ⁻¹²	6.9x10 ⁻⁷	1.0x10 ⁻⁷
Beyond design basis earthquake	7.3x10 ⁻⁸	0.015	1.3x10 ⁻⁹	2.6x10 ⁻⁴	1.4x10 ⁻⁷	0.027	1.0x10 ⁻⁷
Expected risk ^d	4.0x10 ⁻⁵	–	9.2x10 ⁻⁷	–	9.5x10 ⁻⁵	–	–

^a The risk values are calculated by multiplying the probability of cancer fatality (for the worker at 1,000 m or the maximum offsite individual) or the number of cancer fatalities (for the population to 80 km) by the accident frequency and the number of years of operation.

^b Increased likelihood (or probability) of cancer fatality to a hypothetical individual (a single onsite worker at a distance of 1,000 m or the site boundary, whichever is smaller or to a hypothetical individual in the offsite population located at the site boundary) if exposed to the indicated dose. The value assumes the accident has occurred.

^c Estimated number of cancer fatalities in the entire offsite population out to a distance of 80 km if exposed to the indicated dose. The value assumes the accident has occurred.

^d Expected risk is the sum of the risks for each accident over the 50-year lifetime of the facility.

Note: All values are mean values.

Source: Calculated using the source terms in Tables M.5.2.1.1–5 and M.5.2.1.1–6 and the MACCS computer code.

Modify Existing Tunnel Drifts and Construct New Material Handling Building at the P-Tunnel

Normal Operation. There would be no radiological releases during the construction of a new, but larger (than for consolidation) material handling building or from modifying P-Tunnel drifts at NTS. Worker exposures to material potentially contaminated with radioactivity (for example, from construction activities involved with existing contaminated soil) would be limited to assure that doses are maintained ALARA. Toward this end, construction workers would be monitored as appropriate. Limited hazardous chemical releases are anticipated as a result of construction activities. However, concentrations would be within the regulated exposure limits. During normal operation, there would be both radiological and hazardous chemical releases to the environment as well as direct in-plant exposures. The resulting doses and potential health effects to the public and workers are described below.

Radiological Impacts. Radiological impacts to the public resulting from the normal operation of the modified P-Tunnel drifts and the associated handling building at NTS are included in the information presented in Table 4.2.2.9–1. The impacts from all site operations are also given in the table. To put operational doses into perspective, comparisons with natural background radiation doses are also included in the table. Similar information regarding radiological impacts to workers is given in Table 4.2.2.9–2. [Text deleted.]

The dose to the MEI due to annual storage operation in the P-Tunnel and handling building would be 5.6x10⁻⁶ mrem. From 50 years of operation, the corresponding risk of fatal cancer to this individual would be 1.4x10⁻¹⁰.

The impacts to the average individual would be less. As a result of storage operations in the year 2030, the population dose would be 1.7×10^{-6} person-rem. The corresponding number of fatal cancers in this population due to 50 years of operation would be 4.3×10^{-8} .

The dose to the MEI due to annual total site operations is within the radiological limits specified in NESHAPS (40 CFR 61, Subpart H) and DOE Order 5400.5, and would be 4.2×10^{-3} mrem. From 50 years of operation, the corresponding risk of fatal cancer to this individual would be 1.0×10^{-7} . The impacts to the average individual would be less. This activity would be included in a program to ensure that doses to the public are ALARA. As a result of total site operation in the year 2030, the population dose would be within the limit in proposed 10 CFR 834 and would be 3.7×10^{-3} person-rem. The corresponding number of fatal cancers in this population due to 50 years of operation would be 9.3×10^{-5} .

Doses to onsite workers due to normal operations are given in Table 4.2.2.9–2. Included are involved workers directly associated with the modified P-Tunnel drifts and handling building, workers who are not involved with the modified P-Tunnel drifts and handling building, and the entire workforce at NTS. All doses fall within regulatory limits and administrative control levels. The associated risks and numbers of fatal cancers among the different workers from 50 years of operation are included in the table.

Hazardous Chemical Impacts. Hazardous chemical impacts to the public and to the onsite worker resulting from the normal operations of the collocated storage facility in the P-Tunnel at NTS are presented in Table 4.2.2.9–3.

The HI to the MEI of the public is 2.8×10^{-6} , and the cancer risk is 4.1×10^{-9} as a result of operation of the collocated storage facilities in the year 2030. The HI and cancer risk would remain constant over 50 years of operation, because exposures would be expected to remain the same. The total site operation in P-Tunnel would result in an HI of 2.8×10^{-6} and a cancer risk of 4.1×10^{-9} for the MEI in the year 2030. This would be expected to remain constant as a result of 50 years of operation.

The HI to the onsite worker at P-Tunnel would be 5.6×10^{-4} , and the cancer risk is 6.4×10^{-6} as a result of operation of the collocated storage facility in the P-Tunnel at NTS in the year 2030. The HI and cancer risk would remain constant over 50 years of operation, because exposures would be expected to remain the same. The total site operation including the consolidated facility would result in an HI of 5.6×10^{-4} and a cancer risk of 6.4×10^{-6} for the onsite worker in the year 2030. This would be expected to remain constant as a result of 50 years of operation.

Facility Accidents. A set of potential accidents for modified P-Tunnel and collocated Pu and HEU storage facilities for which there may be releases of Pu or uranium that may impact onsite workers and the offsite population has been postulated. The consequences and risks of potential accidents that release both Pu and HEU would be bounded by the impacts associated with Pu. The accident consequences and risks to a worker located 1,000 m (3,280 ft) from the accident release point, the maximum offsite individual located at the site boundary, and the population located within 80 km (50 mi) of the accident release point are summarized in Table 4.2.2.9–6. For the set of accidents analyzed, the maximum number of cancer fatalities in the population within 80 km (50 mi) would be 5.3×10^{-4} at NTS for the truckbay fire accident scenario with a probability of 1.0×10^{-7} per year. The corresponding 50-year facility lifetime risk from the same accident scenario for the population, maximum offsite individual, and worker at 1,000 m (3,280 ft), would be 2.7×10^{-9} , 3.6×10^{-10} , and 2.1×10^{-9} , respectively. The maximum population 50-year facility lifetime risk would be 5.1×10^{-5} (that is, one fatality in about 1,000,000 years) at NTS for the PCV penetration by corrosion accident scenario with a probability of 0.064 per year. The corresponding maximum offsite individual and worker 50-year facility lifetime risks would be 6.9×10^{-6} and 4.0×10^{-5} , respectively. Section M.5 presents additional facility accident data and summary descriptions of the accident scenarios identified in Table 4.2.2.9–6.

Construct New Plutonium and Highly Enriched Uranium Storage Facilities

Normal Operation. There would be no radiological releases during the construction of a new collocated storage facility at NTS. Worker exposures to material potentially contaminated with radioactivity would be limited to assure that doses are maintained ALARA. Toward this end, construction workers would be monitored as appropriate. Limited hazardous chemical releases are anticipated as a result of construction activities. However, concentrations would be within the regulated exposure limits. During normal operation, there would be both radiological and hazardous chemical releases to the environment as well as direct in-plant exposures. The resulting doses and potential health effects to the public and workers are described below.

Radiological Impacts. Radiological impacts to the public resulting from the normal operation of the new collocated storage facility at NTS are included in the information presented in Table 4.2.2.9-1. The impacts from all site operations are also given in the table. To put operational doses into perspective, comparisons with natural background radiation doses are also included in the table. Similar information regarding radiological impacts to workers is given in Table 4.2.2.9-2. [Text deleted.]

The dose to the MEI from the annual storage operations in the new storage facility would be 1.3×10^{-6} mrem. For 50 years of operation, the corresponding risk of fatal cancer to this individual would be 3.2×10^{-11} . The impacts to the average individual would be less. As a result of storage operation in the year 2030, the population dose would be 2.6×10^{-6} person-rem. The corresponding number of fatal cancers in this population from 50 years of operation would be 6.5×10^{-8} .

Doses and associated health risks to the public from total site operations are virtually the same whether storage is in the new storage facility or in the modified P-Tunnel drifts (Table 4.2.2.9-1). This is because the storage operations contribute negligibly to the total offsite doses.

Doses to onsite workers due to normal operations are given in Table 4.2.2.9-2. All doses fall within regulatory limits and administrative control levels. The associated risks and numbers of fatal cancers among the different workers from 50 years of operation are included in the table. Dose to individual workers would be kept low by instituting badged monitoring and ALARA programs and also workers rotations. As a result of the implementation of these mitigation measures, the actual number of fatal cancers calculated would be lower for the operation of this facility.

Hazardous Chemical Impacts. Hazardous chemical impacts to the public and to the onsite worker resulting from the normal operations of the new consolidation of Pu storage and collocation with HEU storage facilities at NTS are presented in Table 4.2.2.9-3. The impacts from all site operations, including the consolidation of Pu storage and collocation with HEU storage facilities, are also included in this table. Total site impacts, which include the No Action impact plus the facility impacts, are provided. All analyses to support the values presented in this table are provided in Section M.3

The HI to the MEI of the public is 4.2×10^{-6} , and the cancer risk is 4.1×10^{-9} as a result of operation of the new consolidation of Pu storage and collocation with HEU storage facilities in the year 2030. The HI and cancer risk would remain constant over 50 years of operation, because exposures would be expected to remain the same. The total site operation, including the new facility, would result in an HI of 4.2×10^{-6} and a cancer risk of 4.1×10^{-9} for the MEI in the year 2030. This would be expected to remain constant as a result of 50 years of operation.

The HI to the onsite worker would be 7.2×10^{-4} , and the cancer risk is 6.4×10^{-6} as a result of operation of the new consolidation of Pu storage and collocation with HEU storage facilities in the year 2030. The HI and cancer risk would remain constant over 50 years of operation, because exposures would be expected to remain the same. The total site operation, including the new facility, would result in an HI of 7.2×10^{-4} and a cancer risk of 6.4×10^{-6} for the onsite worker in the year 2030. This would be expected to remain constant as a result of 50 years of operation.

Facility Accidents. A set of potential accidents for a new storage facility for collocated Pu and HEU for which there may be releases of Pu or HEU that may impact onsite workers and the offsite population has been postulated. The consequences and risks of potential accidents that release both Pu and HEU would be bounded by the impacts associated with Pu. The accident consequences and risks to a worker located 1,000 m (3,280 ft) from the accident release point, the maximum offsite individual located at the site boundary, and the population located within 80 km (50 mi) of the accident release point are summarized in Table 4.2.2.9–7. For the set of accidents analyzed, the maximum number of cancer fatalities in the population within 80 km (50 mi) would be 0.027 at NTS for the beyond design basis earthquake accident scenario with an estimated probability of 1.0×10^{-7} per year (that is, probability of severe earthquake occurring is estimated to be about 1.0×10^{-5} , once in 100,000 years, multiplied by a damage and release probability of 0.01). The corresponding 50-year facility lifetime risk from the same accident scenario for the population, maximum offsite individual, and worker at 1,000 m (3,280 ft), would be 1.4×10^{-7} , 1.3×10^{-9} , and 7.3×10^{-8} , respectively. The maximum population 50-year facility lifetime risk would be 9.4×10^{-5} (that is, one fatality in about 530,000 years) at NTS for the PCV penetration by corrosion accident scenario with a probability of 0.064 per year. The corresponding maximum offsite individual and worker 50-year facility lifetime risks would be 9.1×10^{-7} and 3.9×10^{-5} , respectively. Appendix M.5 presents additional facility accident data and summary descriptions of the accident scenarios identified in Table 4.2.2.9–7.

Subalternative Not Including Strategic Reserve and Weapons Research and Development Materials

If the strategic reserve and weapons R&D materials are not included, the impacts to the public and to workers from the accident-free storage activities would be reduced in proportion to the decrease in the amount of material stored. The impacts from total site operations would decrease slightly. The risks due to accidents would also tend to be lower.

4.2.2.10 Waste Management

This section summarizes the impacts on waste management at NTS under No Action and for each of the long-term storage alternatives. There is no spent nuclear fuel or HLW associated with Pu or HEU storage. Table 4.2.2.10–1 lists the projected sitewide waste generation rates and treatment, storage, and disposal capacities under No Action for 2005. Projections for No Action were derived from the most recent applicable environmental data, with the appropriate adjustments made for those changing operational requirements where the volumes of wastes generated are identifiable. The projections do not include waste from future, yet uncharacterized, environmental restoration activities. The projections for No Action could change significantly depending on the decisions resulting from the Waste Management PEIS or the NTS Site-Wide EIS. Table 4.2.2.10–2 provides the estimated incremental operational waste volumes projected to be generated at NTS as a result of the various storage alternatives prior to treatment. Some of the waste values described in this section are different than the waste values in the table. For those values that differ (for example LLW), the table gives waste generated pre-treatment values and the text discusses post-treatment values (indicated as after treatment and volume reduction). The waste volumes generated from the various storage alternatives that were added to the No Action projection and the resultant waste effluent used for the waste impact analysis are shown in Section E.3.1. Facilities that would support the storage of Pu and/or HEU would treat and package all generated waste into forms that would enable staging and/or disposal in accordance with RCRA and other applicable statutes as outlined in Section E.1.2. Depending in part on decisions in waste-type-specific RODs for the Waste Management PEIS and in subsequent RODs and NEPA documents, wastes could be treated and disposed of onsite or at regionalized or centralized DOE sites. For purposes of analyses only, this PEIS assumes that TRU and mixed TRU waste would be treated onsite to the current planning-basis WIPP WAC, and shipped to WIPP for disposal. This PEIS also assumes that LLW, mixed LLW, hazardous, and nonhazardous wastes would be treated and disposed of in accordance with current site practice.

Preferred Alternative: No Action Alternative

Under this alternative, TRU, low-level, mixed, hazardous, and nonhazardous wastes would continue to be managed from the missions outlined in Section 3.3. The disposal of waste received from offsite would not involve treatment at NTS, since this waste must be treated, packaged, and certified to NTS WAC before being shipped to NTS for disposal. NTS has retrievable storage of TRU waste awaiting shipment to a Federal repository. Although there would be no generation of TRU waste onsite, mixed TRU waste from LLNL would continue to be stored at NTS. Solid mixed LLW would be stored and treated in accordance with the NTS Site Treatment Plan. Hazardous waste would be accumulated, then shipped offsite for treatment and disposal at commercial RCRA-permitted facilities. Nonhazardous and sanitary wastes would be treated and disposed of locally in facilities located within the separate activity areas onsite.

Consolidation Alternative

Modify Existing Tunnel Drifts and Construct New Material Handling Building at the P-Tunnel

Construction and operation of a consolidated Pu storage facility using P-Tunnel would have an impact on existing NTS waste management activities, increasing the generation of TRU, low-level, mixed, hazardous, and nonhazardous wastes. Waste generated during construction would consist of wastewater and solid nonhazardous and hazardous wastes. The nonhazardous waste would be disposed of as part of the construction project by the contractor, and the hazardous waste would be shipped to commercial RCRA-permitted treatment and disposal facilities. No soil contaminated with hazardous material or radioactive constituents is expected to be generated during construction. However, if any was generated it would be managed in accordance with site practice and all applicable Federal and State regulations.

After treatment and volume reduction, approximately 5 m³ (7 yd³) of TRU waste and 4 m³ (5 yd³) of mixed TRU waste from leaded gloves, windows, and contaminated lead shielding would be treated and packaged to

meet the current planning-basis WIPP WAC or alternative treatment level. While awaiting shipment to WIPP (depending on decisions made in the ROD associated with the supplemental EIS for the proposed continued phased development of WIPP for disposal of TRU waste), the TRU and mixed TRU waste would be stored at the TRU Pad Waste Storage in Area 5. One additional truck shipment per year would be required to transport these wastes to WIPP.

Following treatment and volume reduction, approximately 630 m³ (824 yd³) of LLW from solidified liquid LLW (such as decontamination solutions), protective clothing, HEPA filters, glovebox gloves, and decontamination equipment and materials would require disposal in the Area 5 or Area 3 RWMS. Assuming a land usage of 6,000 m³/ha (3,200 yd³/acre), this would require approximately 0.1 ha/year (0.3 acres/year) of LLW disposal area. The 0.2 m³ (50 gal) of liquid and 65 m³ (85 yd³) of solid mixed LLW would be treated and disposed of in accordance with the NTS Site Treatment Plan through the use of existing and planned facilities. The 2 m³ (476 gal) of liquid and 2 m³ (3 yd³) of solid hazardous wastes would have a minimal impact on waste management activities at NTS. Existing facilities at the Area 5 Hazardous Waste Storage Unit are adequate to stage the increase in hazardous waste while awaiting shipment to an offsite commercial RCRA-permitted treatment and disposal facility. New sanitary lagoons would be required to treat the 135,000 m³ (35,600,000 gal) of nonhazardous liquid wastes. After volume reduction, 810 m³ (1,060 yd³) of solid nonhazardous waste would require disposal at one of the onsite landfills.

Construct New Plutonium Storage Facility

Construction and operation of a consolidated Pu storage facility would have an impact on existing waste management activities identical to that described above for the P-Tunnel facility, with the following exceptions. Construction of sanitary, utility, and process wastewater treatment systems would be required to treat approximately 114,000 m³ (30,100,000 gal) of liquid nonhazardous waste. After volume reduction, 750 m³ (981 yd³) of solid nonhazardous waste would require disposal at one of the onsite facilities.

Collocation Alternative

Modify Existing Tunnel Drifts and Construct New Material Handling Building at the P-Tunnel

Construction and operation of a consolidated Pu storage facility collocated with HEU storage using the P-Tunnel would have an impact on existing NTS waste management activities, increasing the generation of TRU, low-level, mixed, hazardous, and nonhazardous wastes. Waste generated during construction would consist of wastewater and solid nonhazardous and hazardous wastes. The nonhazardous waste would be disposed of as part of the construction project by the contractor, and the hazardous waste would be shipped to commercial RCRA-permitted treatment and disposal facilities. No soil contaminated with hazardous material or radioactive constituents is expected to be generated during construction. However, if any was generated it would be managed in accordance with site practice and all applicable Federal and State regulations.

Since there is no TRU or mixed TRU wastes associated with HEU storage, the impacts from TRU and mixed TRU wastes are identical to those identified in the consolidated Pu storage alternative. The sources of waste are similar to those of the consolidated Pu storage facility, except the source of radioactive contamination from the HEU storage is uranium.

Following treatment and volume reduction, approximately 630 m³ (824 yd³) of LLW contaminated with Pu and 20 m³ (26 yd³) contaminated with uranium would require disposal in the Area 5 or Area 3 RWMS. Assuming a land usage of 6,000 m³/ha (3,200 yd³/acre), this would require approximately 0.1 ha/yr (0.3 acre/yr) of LLW disposal area. The 0.2 m³ (55 gal) of liquid mixed LLW and 66 m³ (86 yd³) of solid mixed LLW would be treated and disposed of in accordance with the NTS Site Treatment Plan through the use of existing and planned facilities. The 2 m³ (528 gal) of liquid and 2 m³ (3 yd³) of solid hazardous wastes would have a minimal impact on waste management activities at NTS. Existing facilities at the Area 5 Hazardous Waste Accumulation Site

are adequate to stage the increase in hazardous waste while awaiting shipment to an offsite commercial RCRA-permitted treatment and disposal facility. New sanitary lagoons would be required to treat the 189,000 m³ (49,900,000 gal) of liquid nonhazardous waste. After volume reduction, 980 m³ (1,280 yd³) of solid nonhazardous waste would require disposal at one of the onsite landfills.

Construct New Plutonium and Highly Enriched Uranium Storage Facilities

Construction and operation of a consolidated Pu storage facility collocated with HEU storage would have an impact on existing NTS waste management activities identical to that described above for the modified P-Tunnel facility, with the following exceptions. Construction of sanitary, utility, and process wastewater treatment systems would be required to treat approximately 153,000 m³ (40,500,000 gal) of nonhazardous waste. After volume reduction, 950 m³ (1,240 yd³) of solid nonhazardous waste would require disposal at one of the onsite landfills.

Subalternative Not Including Strategic Reserve and Weapons Research and Development Materials

The exclusion of strategic reserve or weapons R&D materials would reduce the amount of operational waste volumes shown in Table 4.2.2.10–2 for the Consolidation Alternative and the Collocation Alternative. The decrease would be proportional to the amount of material excluded. [Text deleted.]

4.2.3 IDAHO NATIONAL ENGINEERING LABORATORY

A listing of the proposed long-term storage alternatives, subalternatives, and related actions, including the No Action Alternative at INEL, is provided below. The potential impacts of implementing these alternatives and related actions at INEL are described for: land resources, site infrastructure, air quality and noise, water resources, geology and soils, biological resources, cultural and paleontological resources, socioeconomics, public and occupational health and safety, and waste management. The specific long-term storage alternatives proposed for INEL are the Upgrade Alternative, the Consolidation Alternative, and the Collocation Alternative.

Preferred Alternative

No Action Alternative:

Continue to store INEL Pu material within the scope of this PEIS at ANL-W in the ZPPR and FMF vaults and the ICPP in stabilized form pursuant to DNFSB Recommendation 94-1.

Proposed Storage Activities at Idaho National Engineering Laboratory

- **No Action Alternative (Preferred Alternative):** Continue to store INEL Pu material within the scope of this PEIS at ANL-W in the ZPPR and FMF vaults and the ICPP in stabilized form pursuant to DNFSB Recommendation 94-1.
- **Upgrade Alternative:** There are two subalternatives under this storage alternative.
 - **Upgrade Without RFETS Pu or LANL Pu Subalternative:** Modify the FMF and construct a new material handling building at ANL-W to accommodate INEL Pu material.
 - **Upgrade With All or Some RFETS Pu and LANL Pu Subalternative:** Modify the FMF and construct a larger new material handling building at ANL-W to accommodate INEL, RFETS, and LANL Pu material.
- **Consolidation Alternative:** Construct a new facility near the ICPP to accommodate all Pu material within the scope of this PEIS.
- **Collocation Alternative:** Construct a new facility near the ICPP to accommodate all Pu and HEU material within the scope of this PEIS.
- **Subalternative Not Including Strategic Reserve and Weapons Research and Development Materials:** Facility and other resource requirements would be smaller than the Upgrade With All or Some RFETS Pu and LANL Pu Subalternative, the Consolidation Alternative, and the Collocation Alternative.
- **Phaseout:** INEL Pu material within the scope of this PEIS would be moved out of ANL-W to the Consolidation or Collocation site (located at another DOE site) or to disposition (for surplus Pu).

4.2.3.1 Land Resources

Preferred Alternative: No Action Alternative

Under this alternative, Pu storage would continue at the current interim storage locations at the ICPP and at ANL-W in the ZPPR and FMF vaults in stabilized form pursuant to DNFSB Recommendation 94-1. The ongoing (no new action) activities conform with present and future land-use plans, policies, and controls. Therefore, no effects to land use or visual resources would be anticipated at INEL beyond those of existing and future activities that are independent of the proposed action.

Upgrade Alternative

Upgrade Without Rocky Flats Environmental Technology Site Plutonium or Los Alamos National Laboratory Plutonium Subalternative

Modify Existing and Construct New Argonne National Laboratory–West Facilities for Continued Plutonium Storage

Long-term storage of the existing inventory of INEL Pu material would be accommodated at ANL-W on the INEL site. The proposed facility would be a modification of the FMF on the ANL-W and construction of a new material handling building. Construction laydown area and the operating facility would be situated on previously disturbed land entirely within an upgraded protected area of ANL-W totalling approximately 9 ha (22 acres) and would not create any newly disturbed area. A buffer zone exists between ANL-W operations and the INEL site boundary. [Text deleted.]

Land Use. Upgrading existing storage facilities and constructing a new material handling building at ANL-W would have no direct land-use effect during construction or operations. Existing land use would not change and would conform with site development and facility utilization plans. As discussed in Section 4.2.3.8, no in-migration of workers would be required during the construction and operation phases. No indirect effects to offsite land use would be anticipated.

Construction and operation would not affect other land uses at INEL or special status lands. Construction and operation would not be in conflict with land-use plans, policies, and controls of adjacent counties and the city of Idaho Falls since they do not address the potential site.

Visual Resources. [Text deleted.] Construction and operation of the facilities would be compatible with the industrial landscape character of ANL-W. The current VRM Class 5 designation of ANL-W would not change.

Upgrade With All or Some Rocky Flats Environmental Technology Site Plutonium and Los Alamos National Laboratory Plutonium Subalternative

Modify Existing and Construct New Argonne National Laboratory–West Facilities for Continued Plutonium Storage

The FMF would be modified, and a material handling building would be constructed at ANL-W to accommodate INEL, RFETS, and LANL Pu material. Land area requirements during construction and operations would be equal to the Upgrade Without RFETS Pu or LANL Pu Subalternative (that is, protected area). Direct and indirect effects on land resources during construction and operations would be similar to the Upgrade Alternative, Upgrade Without RFETS Pu or LANL Pu Subalternative.

Consolidation Alternative

Construct New Plutonium Storage Facility

All the Pu within the scope of the PEIS would be stored at a new storage facility to be constructed at INEL within the Prime Development Zone of the Sitewide Area near the ICPP. Land disturbance would be 58.5 ha (144 acres) during construction of which 56 ha (138 acres) would be used during operations. A buffer zone would be provided between operations and the INEL site boundary. Pu storage in existing DOE storage facilities would be phased out.

Land Use. Consolidating the storage of Pu at INEL would be situated on undisturbed land. However, the proposed site is within designated prime development land pursuant to the current *Idaho National Engineering Laboratory Site Development Plan* (IN DOE 1994d:8-4) although existing land use would change. As discussed in Section 4.2.3.8, expected vacancies and historic housing construction rates indicate that sufficient housing would be available to accommodate the estimated in-migration of workers during the construction and operational phases. Therefore, indirect effects to offsite land use would not be anticipated.

Construction and operation would not be in conflict with land-use plans, policies, and controls of adjacent counties and the city of Idaho Falls since they do not address the potential site. Construction and operation would not affect other land uses at INEL or special status lands. No onsite grazing permits would be affected. No prime farmlands exist onsite.

Visual Resources. [Text deleted.] Construction and operation would be compatible with the industrial character of INEL's developed areas, which consist of large industrial facilities and stack plumes. The current VRM Class 5 designation of the proposed site would not change.

Collocation Alternative

Construct New Plutonium and Highly Enriched Uranium Storage Facilities

All the Pu and HEU within the scope of this PEIS would be collocated at a primary new storage plant at INEL, on undisturbed land in the Prime Development Zone of the Sitewide Area near the ICPP. Land disturbance would be 89.5 ha (221 acres) during construction of which 87 ha (215 acres) would be used during operation. A buffer zone would be provided between operations and the INEL site boundary. Pu and HEU storage in existing DOE storage facilities would be phased out. Direct and indirect effects on land resources would be similar to those described under the Consolidation Alternative.

Subalternative Not Including Strategic Reserve and Weapons Research and Development Materials

Under this subalternative, land effects during construction and operation would be almost the same in extent and magnitude to the Upgrade with All or Some RFETS Pu and LANL Pu Subalternative, Consolidation Alternative, and Collocation Alternative because the facility would be almost the same. However, because the smaller quantity of material would require smaller facilities, it is likely that less land area would be disturbed during construction and used during operations. [Text deleted.]

Phaseout

No new construction or upgrade of existing facilities would occur under phaseout of the Pu mission. INEL Pu material would be moved out of ANL-W to the Consolidation or Collocation site or to disposition. Potential impacts on visual resources could occur if facilities are not maintained.

[Text deleted.]

4.2.3.2 Site Infrastructure

The INEL infrastructure would be capable of supporting any of the storage alternatives without major modifications to the existing infrastructure. A comparison of site infrastructure and facilities resource needs for the various storage alternatives is shown in Table 4.2.3.2-1.

Preferred Alternative: No Action Alternative

INEL would continue Pu storage at ANL-W. No change to the baseline infrastructure is anticipated, and no additional environmental impacts would be expected.

Upgrade Alternative

Upgrade Without Rocky Flats Environmental Technology Site Plutonium or Los Alamos National Laboratory Plutonium Subalternative

Modify Existing and Construct New Argonne National Laboratory–West Facilities for Continued Plutonium Storage

Modifying the existing storage facility plus building a new facility to accommodate long-term storage of existing quantities of Pu at INEL would have minimal impact on site infrastructure. Data for construction are presented in Appendix C. [Text deleted.] As shown in Table 4.2.3.2-1, the INEL infrastructure would be capable of supporting the modification of the existing storage facility without major improvements. Adequate electrical energy is available from the regional power grid. [Text deleted.] All infrastructure requirements are within site capacities.

Upgrade With All or Some Rocky Flats Environmental Technology Site Plutonium and Los Alamos National Laboratory Plutonium Subalternative

Modify Existing and Construct New Argonne National Laboratory–West Facilities for Continued Plutonium Storage

To accommodate material currently at the site, plus the relocation of material from RFETS and LANL, the ANL-W storage capacity would be upgraded by constructing a new 2,550 m² (27,400 ft²) Material Handling Building to augment modified existing support buildings and by using balance of plant facilities. Building 704 would be modified for an additional 4,100 storage positions above that of the baseline upgrade, while Buildings 774 and 775 would be modified for storage support. The buildings would be interconnected by a new material transfer access corridor.

Construction for upgrading the existing storage facility, plus building a new facility to accommodate long-term storage of existing quantities of Pu, plus material relocated from RFETS and LANL would have minimal impact on site infrastructure. Data for construction are presented in Appendix C. As shown in Table 4.2.3.2-1, additional electrical energy, and peak load would be required to operate the facility. The INEL infrastructure would be capable of supporting the modification of the existing storage facility, plus building a new facility to accommodate long-term storage of existing quantities of Pu, plus material relocated from RFETS and LANL without major improvements. Adequate electrical energy is available from the regional power grid. [Text deleted.] All infrastructure requirements are within site capacities.

Since impacts associated with relocating all of the RFETS Pu and LANL Pu material to INEL for long-term storage are minimal for construction and can be managed for operations, relocating only a portion of this material to INEL would result in minimal impacts on the site infrastructure as well. Additional annual electrical energy requirements would be proportionately less than the 700 MWh/yr required for storage of the full amount of RFETS Pu and LANL Pu material, depending on the amount of material relocated to the site.

Consolidation Alternative

Construct New Plutonium Storage Facility

Under this alternative, all the Pu within the scope of this PEIS would be stored at a new storage facility located at INEL. Construction requirements would constitute a small change in resource requirements at INEL. Since coal availability is governed by usage and not by site storage capacity, the additional coal required could be procured through contractual means. Impacts on the site infrastructure would be negligible. The INEL infrastructure would be capable of supporting operation of the consolidated Pu storage facility without major modifications to the existing infrastructure. As shown in Table 4.2.3.2–1, less than 5 km (3 mi) of roads and less than 5 km (3 mi) of railroad lines would need to be added to the site. Adequate electrical energy is available from the regional power grid.

Collocation Alternative

Construct New Plutonium and Highly Enriched Uranium Storage Facilities

Under this alternative, all the HEU within the scope of this PEIS would be stored at INEL in a new storage facility, collocated with the consolidated Pu storage facility. Construction requirements would constitute a small change in resource requirements for INEL. Since coal availability is governed by usage and not by site storage capacity, the additional coal required could be procured through contractual means. As shown in Table 4.2.3.2–1, less than 5 km (3 mi) of roads and less than 5 km (3 mi) of railroad lines would need to be added to the site. The INEL infrastructure would be capable of supporting operation of the consolidated and collocated facilities without major modifications to the existing infrastructure. Adequate electrical energy is available from the regional power grid.

Subalternative Not Including Strategic Reserve and Weapons Research and Development Materials

Since the existing INEL site infrastructure would be fully capable of supporting construction/modification and operation of facilities for the Upgrade With All or Some RFETS Pu and LANL Pu, Consolidation of Pu, and Collocation of Pu and HEU Alternatives, constructing and operating such facilities without including provisions for storage of strategic reserve and weapons R&D materials could be accommodated as well. Expected reductions in amounts of annual electrical energy requirements for the various storage facilities are the only site infrastructure changes expected if this subalternative is chosen because electric usage is dependant on the amount of material. [Text deleted.]

Phaseout

Because of the relatively small amounts of Pu located on the site, INEL storage operations at ANL-W would be phased out with minimal impact on the site infrastructure.

4.2.3.3 Air Quality and Noise

Construction and operation activities associated with the No Action Alternative and the proposed storage alternatives would generate criteria and toxic/hazardous pollutants. To evaluate the air quality impacts at INEL, criteria and toxic/hazardous concentrations from the No Action Alternative and the proposed storage alternatives are compared with Federal and State standards and guidelines. Impacts from radiological airborne emissions are described in Section 4.2.3.9.

In general, all of the proposed storage facilities would emit the same types of air pollutants during construction. It is expected emissions would not exceed Federal, State, or local air quality regulations. PM₁₀ and TSP concentrations will be increased, especially during peak construction periods.

The principal sources of emissions during construction include the following:

- Fugitive dust from land clearing, site preparation, excavation, and wind erosion of exposed ground surfaces
- Exhaust and road dust generated by construction equipment, vehicles delivering construction materials, and vehicles carrying construction workers

During operation, impacts from each of the individual storage facilities with respect to the concentrations of criteria and toxic/hazardous air pollutants are predicted to be in compliance with Federal, State, and local air quality regulations or guidelines. Table 4.2.3.3–1 presents the estimated pollutant concentrations for each of the fissile materials storage alternatives, indicating little difference between alternatives with respect to impacts on air quality.

Emission rates attributed to operation of the proposed storage facilities are presented in Tables F.1.3–1 to F.1.3–3. [Text deleted.] Air pollutant emission sources associated with operations include the following:

- Operation of boilers for space heating
- Operation of diesel generators and periodic testing of emergency diesel generators
- Exhaust and road dust generated by vehicles delivering supplies and bringing employees to work
- Toxic/hazardous pollutant emissions from facility processes

Noise impacts during either construction or operation are expected to be low. Air quality and noise impacts for each storage alternative are described separately. Supporting data for the air quality and noise analysis are presented in Appendix F.

AIR QUALITY

An analysis was conducted of the potential air quality impacts of emissions from each of the storage alternatives as described in Section 4.1.3.

Section 176 (c) of the 1990 CAA amendments requires that all Federal actions conform with the applicable state implementation plan. EPA has implemented rules that establish the criteria and procedures governing the determination of conformity for all Federal actions in nonattainment and maintenance areas. These are discussed in Section 4.1.3. The attainment status of the area in which INEL is located is discussed in Section 3.4.3. Since

the area is considered to be an attainment area for criteria pollutants, the proposed actions at this site do not require that a conformity analysis be performed.

Preferred Alternative: No Action Alternative

This alternative utilizes estimated air emissions data from total site operations at INEL assuming continuation of site missions as described in Section 3.4. These data reflect conservative estimates of criteria and toxic/hazardous emissions at INEL. The emission rates for the criteria and toxic/hazardous pollutants for No Action are presented in Table F.1.2.4–1. Table 4.2.3.3–1 presents the No Action concentrations. During dry and windy conditions, increased PM₁₀ and TSP concentrations may occur due to ongoing construction associated with other activities (that are outside of the scope of this PEIS) under the No Action Alternative. Concentrations of all other criteria and toxic/hazardous air pollutants at the site boundary or public access highways are expected to remain within applicable Federal, State, and local ambient air quality standards.

Upgrade Alternative

Upgrade Without Rocky Flats Environmental Technology Site Plutonium or Los Alamos National Laboratory Plutonium Subalternative

Modify Existing and Construct New Argonne National Laboratory–West Facilities for Continued Plutonium Storage

Particulate matter and TSP concentrations are expected to increase during the peak construction period, particularly during dry and windy conditions. Appropriate control measures would be followed to minimize pollutant concentrations during construction. It is expected that concentrations of all pollutants at the site boundary or public access highways would remain within applicable Federal and State ambient air quality standards during construction of new and modified facilities.

During operation, concentrations of criteria and toxic/hazardous air pollutants are predicted to be in compliance with Federal, State, and local air quality regulations or guidelines. Estimated pollutant concentrations attributable to increased operations associated with this storage alternative, plus the No Action concentrations, are presented in Table 4.2.3.3–1. Concentrations of air pollutants are expected to be the same with or without the RFETS and LANL material.

Upgrade With All or Some Rocky Flats Environmental Technology Site Plutonium and Los Alamos National Laboratory Plutonium Subalternative

Modify Existing and Construct New Argonne National Laboratory–West Facilities for Continued Plutonium Storage

Air quality impacts for construction and operation for this subalternative are expected to be similar to those previously described for the Upgrade Alternative for INEL.

Consolidation Alternative

Construct New Plutonium Storage Facility

In addition to the types of sources of emissions during construction associated with the No Action and upgrade of storage facilities, fugitive dust resulting from the operation of a concrete batch plant would be an additional emission source associated with a new facility. PM₁₀ and TSP concentrations may increase during the peak construction period for a new facility, particularly during dry and windy conditions. Appropriate control measures would be followed to minimize pollutant concentrations during construction. It is expected that

construction period for a new facility, particularly during dry and windy conditions. Appropriate control measures would be followed to minimize pollutant concentrations during construction. It is expected that concentrations of all pollutants at the site boundary or public access highways would remain within applicable Federal and State ambient air quality standards during construction.

During operation, impacts of criteria and toxic/hazardous air pollutants are predicted to be in compliance with Federal, State, and local air quality regulations or guidelines. Estimated pollutant concentrations attributable to increased operations associated with this storage alternative, plus the No Action concentrations, are presented in Table 4.2.3.3-1.

Collocation Alternative

Construct New Plutonium and Highly Enriched Uranium Storage Facilities

The Pu and HEU Collocation Alternative would be located in the same area as the consolidation Pu facility and would have similar air quality impacts, with the following exceptions. During operation, emissions would be higher, as shown in Appendix F. Impacts of criteria and toxic/hazardous air pollutants are predicted to be in compliance with Federal, State, and local air quality regulations or guidelines. Estimated pollutant concentrations attributable to increased operations associated with this storage alternative, plus the No Action concentrations, are presented in Table 4.2.3.3-1.

Subalternative Not Including Strategic Reserve and Weapons Research and Development Materials

Air quality impacts for construction and operation for this subalternative are expected to be similar to those previously described for the Upgrade With All or Some RFETS and LANL Pu Subalternative, the Consolidation Alternative, and the Collocation Alternative. [Text deleted.]

Phaseout

Phaseout of existing Pu inventories as a result of consolidating Pu at another site is expected to result in a small reduction in air pollutant concentrations from the No Action concentrations and would be in compliance with Federal and State standards.

NOISE

The location of the proposed storage facilities relative to the site boundary and sensitive receptors was examined to evaluate the potential for onsite and offsite noise impacts. Noise sources during construction may include heavy construction equipment and increased traffic. Increased traffic would occur onsite and along offsite local and regional transportation routes used to bring construction materials and workers to the site.

Preferred Alternative: No Action Alternative

Nontraffic noise sources associated with continued storage and other ongoing missions are the same as described in Chapter 3. The continuation of operations at INEL would result in no appreciable change in traffic noise and onsite operational noise sources from current levels. Nontraffic noise sources are located at a sufficient distance from offsite areas that the contribution to offsite noise levels would continue to be small. Due to the size of the site, noise emissions from construction equipment and operations activities would not be expected to cause annoyance to the public. Some noise sources may be located close enough to onsite noise sensitive areas to result in impacts, such as disturbance of wildlife.

Upgrade, Consolidation, and Collocation Alternatives

Nontraffic noise sources associated with the storage Upgrade Alternative would be similar to those for existing facilities as discussed in Chapter 3. Nontraffic, operational noise sources associated with the storage alternatives include existing or additional equipment and machines (cooling systems, vents, motors, and material handling equipment). These noise sources would be located at a sufficient distance from offsite areas that the contribution to offsite noise levels would be small. Due to the size of the site, noise emissions from construction equipment and operations activities would not be expected to cause annoyance to the public. Some noise sources may result in impacts, such as disturbance of wildlife.

Subalternative Not Including Strategic Reserve and Weapons Research and Development Materials

Noise impacts for construction and operations for this option are expected to be almost the same as those previously described for the Consolidation Alternative and the Collocation Alternative because noise impacts are based on the use of the facility and not the size. [Text deleted.]

Phaseout

A reduction in noise levels associated with facility operations may result from the phaseout of storage facilities.

4.2.3.4 Water Resources

Construction and operation of the proposed long-term storage facilities at INEL would affect water resources. No surface water would be withdrawn for construction or for normal operations. Instead, groundwater from the Snake River Plain Aquifer would be used, which is a sufficient source. Water requirements for normal operation for all storage options would fall within INEL's current allotment (43,000 million l/yr [11,360 million gal/yr]). The site proposed for the upgraded storage facilities would be outside the floodplain that could result from failure of MacKay Dam during a probable maximum flood. The site proposed for the Consolidation or Collocation Alternative, however, falls within that floodplain. During construction, treated sanitary wastewater would be discharged to lined evaporation ponds. While the potential impacts on surface water during the construction phase would result from erosion and sedimentation of drainage channels, the relatively dry climate and application of appropriate controls should preclude these potential impacts. No wastewater would be discharged on surface waters during operation of the facilities, nor would there be impacts on surface water quality from these activities. All wastewater would be treated and recycled for cooling system makeup. Stormwater runoff would be collected and treated, if necessary, before discharge to natural drainage channels. [Text deleted.] Table 4.2.3.4–1 presents No Action water resources uses and discharges and the potential changes to water resources at INEL resulting from the long-term storage alternatives.

Preferred Alternative: No Action Alternative

Surface Water. A description of the activities that would continue at INEL is provided in Section 3.4. Treated wastewater discharged to evaporation/infiltration ponds is expected to continue at a rate of 540 million l/yr (142.7 million gal/yr).

Groundwater. Under this alternative, no additional impacts on groundwater resources are anticipated. Current groundwater usage of 7,949 million l/yr (2,100 million gal/yr) is anticipated to decrease to 7,570 million l/yr (2,000 million gal/yr) by 2005. Existing tritium plumes in groundwater and in perched groundwater are expected to continue to migrate southwest slowly. Studies show that water withdrawals could change the existing plumes' southwesterly direction to the east.

Upgrade Alternative

Upgrade Without Rocky Flats Environmental Technology Site Plutonium or Los Alamos National Laboratory Plutonium Subalternative

Modify Existing and Construct New Argonne National Laboratory-West Facilities for Continued Plutonium Storage

Surface Water. There are no unique construction characteristics associated with water requirements and discharges from this alternative. No surface water would be withdrawn for any construction or operation activities associated with any of the proposed upgraded Pu storage facilities. Therefore, there would be no impacts on surface water availability. Nonhazardous wastewater generated during construction and operation of the upgraded Pu storage facilities would be diverted to either the sanitary or industrial waste treatment ponds, where it would be allowed to evaporate into the atmosphere and percolate into the subsurface. It is expected that a total of approximately 4.0 million l/yr (1.1 million gal/yr) of nonhazardous wastewater would be generated during the construction phase. This water would be discharged to the sanitary wastewater treatment ponds, where it would undergo aerobic and anaerobic treatment and then be allowed to evaporate to the atmosphere and percolate into the subsurface under NPDES permit requirements.

[Text deleted.]

During operation, utility, process, and sanitary wastewater for the upgraded Pu storage facilities would be diverted to the sanitary waste treatment ponds, where it would undergo aerobic and anaerobic treatment and then be allowed to evaporate into the atmosphere and percolate into the subsurface. Similarly, cooling system blowdown and stormwater runoff would be diverted to the industrial waste treatment ponds and ANL-W sewage lagoons, where it would be allowed to evaporate or percolate. Industrial and sanitary wastewater treatment pond water is monitored for the parameters specified in the site-specific NPDES permit. If evaporation pond capacity is limited, uncontaminated effluents would be discharged to natural drainage channels. Contaminated effluents would be diverted to, and treated in, the liquid radioactive waste treatment system before disposal.

No construction would occur in areas delineated as 100-year floodplains. The proposed site is also located above the maximum probable flood elevation, which is higher than the 500-year flood elevation. The closest large surface water body, the Big Lost River, is located approximately 16 km (10 mi) west of the proposed site. Because INEL is in a region where flash floods could occur, the facilities would be designed to withstand such flooding.

Groundwater. All water required for construction and operation would be supplied from groundwater from the Snake River Plain Aquifer. Construction water requirements for the upgraded Pu storage upgrade are small relative to INEL's total usage. As shown in Table 4.2.3.4-1, upgrading the ANL-W facilities would require approximately 9.7 million l/yr (2.6 million gal/yr) of water, which represents a 0.1-percent increase over the projected annual groundwater usage. Annual groundwater requirements for operation of the proposed facilities are estimated to be approximately 17 million l (4.5 million gal), which represents a 0.2-percent increase over the projected No Action groundwater usage. This small increase in overall demand should cause minimal impacts. This would increase the total projected amount to be pumped at INEL to under 18 percent of the total allotment.

Construction and operation of the proposed upgraded Pu storage facilities would not result in direct discharges to groundwater. Treated wastewater discharged to evaporation/infiltration ponds, however, would percolate downward into the groundwater. The water would be monitored and would not be discharged into the ponds until contaminant levels are within the limits specified. Impacts on groundwater quality are therefore not expected. In addition, other factors contributing to a lessening of potential impacts on groundwater are the combined effects of a deep water table, low discharge volumes, and high evaporation rates. Therefore, the tritium contamination problem in the Snake River Plain Aquifer, as identified in Section 3.4.4, would not be exacerbated by any of the long-term storage alternatives.

Upgrade With All or Some Rocky Flats Environmental Technology Site Plutonium and Los Alamos National Laboratory Plutonium Subalternative

Modify Existing and Construct New Argonne National Laboratory-West Facilities for Continued Plutonium Storage

The Pu storage upgrade using all or some RFETS Pu and LANL Pu material at INEL would increase water discharges during construction by 6.1 million l/yr (1.6 million gal/yr), or 1.1 percent over the projected No Action discharge during construction. During operations, wastewater would be recycled. All other wastewater requirements and floodplain issues of the Pu storage upgrade with RFETS Pu and LANL Pu material are similar to those of the Pu consolidated option. During construction, Pu storage upgrade using RFETS Pu and LANL Pu material would require 12.5 million l/yr (3.3 million gal/yr), or a 0.2-percent increase over projected No Action water use. During operations, 22 million l/yr (5.8 million gal/yr) of water would be required, or a 0.3-percent increase over projected No Action water use.

Water resources impacts for construction and operation upgrading with some RFETS Pu and LANL Pu material are expected to be similar to, but less than, those previously described for the other storage options at INEL.

Consolidation Alternative

Construct New Plutonium Storage Facility

The new consolidated Pu storage facility would be located just outside the ICPP area of INEL. The impacts associated with it are the same as those discussed above for the upgrade of the existing Pu storage area, with the following exceptions.

Sanitary wastewater quantities generated during construction of this alternative would be approximately 7.8 million l/yr (2.1 million gal/yr). These effluents would be discharged to evaporation/infiltration ponds. No impacts are expected. Surface water would not be used for this option, so no impacts on surface water availability would be expected. The groundwater requirements of this option are slightly greater than those for the previous option. This option would require approximately 85 million l/yr (22.5 million gal/yr) and 66 million l/yr (17.4 million gal/yr) of water for construction and operation, respectively. These additional requirements represent 1.1- and 0.9-percent increases, respectively, in the projected No Action annual withdrawals from the Snake River Plain Aquifer and should not cause any impacts on groundwater availability.

The proposed site for this facility falls within the estimated floodplain that could result from failure of the MacKay Dam during a maximum flood, which would be greater than the 500-year flood.

Collocation Alternative

Construct New Plutonium and Highly Enriched Uranium Storage Facilities

The new consolidated and collocated storage facilities would be located in the same area as the new storage facility, just outside the ICPP area of INEL. The impacts associated with it are the same as those discussed above, with the following exceptions.

Sanitary wastewater quantities generated during construction and operation of this option would be greater than for the previous option and are approximately 12.8 million l/yr (3.4 million gal/yr). These effluents would be discharged to evaporation/infiltration ponds. During operations, wastewater will be recycled. No impacts are expected. Groundwater requirements during construction and operation of this option would be slightly greater than those for the new Pu storage facility. This option would require approximately 104.7 million l/yr (27.7 million gal/yr) and 87 million l/yr (23 million gal/yr) for construction and operation, respectively. These additional requirements represent 1.4- and 1.2-percent increases, respectively, in the projected No Action annual groundwater withdrawals. These small increases boost the total projected groundwater withdrawal to a maximum of 17.8 percent of the groundwater allotment; there should be no impact on groundwater availability.

Subalternative Not Including Strategic Reserve and Weapons Research and Development Materials

Water resource impacts for construction and operation for this option are expected to be slightly less than those previously described for the Pu consolidated and Pu and HEU collocated storage alternatives at INEL because of the reduction in the amount of material. [Text deleted.]

Phaseout

If the current Pu storage mission at INEL was phased out, groundwater withdrawals from the Snake River Plain Aquifer and nonhazardous wastewater discharge to evaporation/percolation ponds would decrease by negligible quantities. No noticeable impacts would occur or be alleviated due to these decreases.

[Text deleted.]

4.2.3.5 Geology and Soils

Construction and operation of the alternatives at INEL would have no impact on the geologic resources. A moderate seismic risk exists, but would be considered in the design of the proposed alternatives. The existing seismic risk does not preclude the safe construction and operation of the proposed alternative facilities. The facilities would be designed for earthquake-generated ground accelerations, in accordance with DOE O 420.1, *Facility Safety*. Because there are no known capable faults at INEL, the potential for ground rupture as a result of an earthquake during the life of a proposed alternative is minimal; ground shaking is more likely. Intensities of approximately VII on the MMI scale are possible but would not affect newly designed facilities. Human health effects from accidents initiated by natural phenomena (for example, earthquakes) are discussed in Section 4.2.3.9. Volcanic activity is improbable during the life of the alternatives and is not anticipated to affect the construction and operation of the alternatives. Lava extrusions could recur with a recurrence probability at approximately once in every 3,000 years. Precursors, such as shallow earthquakes, gas venting activity, and an increase in groundwater temperatures can provide advance warning of most eruption of this type; no such activity is currently indicated at INEL. It is highly unlikely that landslides, sinkhole development, or other nontectonic events would affect project activities. Slopes and underlying foundation materials are generally considered stable. Geologic resources at INEL consist of surficial sand, gravel, or clay deposits that have low economic value. New construction may increase the use of these materials, but because large volumes of these materials are present, the effect to the geologic resource is anticipated to be negligible.

Impacts to the geologic and soil resources occur during, or as a result of, ground-disturbing construction activities. Construction of the alternatives may involve ground-disturbing activities that could affect the soil resources. The amount of land disturbed is specified below for each alternative. Impacts to the soil resource depend on the specific soil units in the disturbed area, the extent of land-disturbing activities, and the amount of soil disturbed. Control measures would be employed to minimize soil erosion. Within INEL, the soil erosion potential is directly related to the amount of land disturbed because soil and climatic conditions are similar throughout the site.

[Text deleted.]

Preferred Alternative: No Action Alternative

Under the No Action Alternative, DOE would continue current and ongoing activities at INEL. There would be no ground-disturbing activities beyond those associated with existing and future site improvements. Because no new construction and the associated ground disturbance for potential soil erosion would occur, the No Action Alternative would have no effect on the soil resources at the site.

Upgrade Alternative

Upgrade Without Rocky Flats Environmental Technology Site Plutonium or Los Alamos National Laboratory Plutonium Subalternative

Modify Existing and Construct New Argonne National Laboratory-West Facilities for Continued Plutonium Storage

No apparent direct or indirect effects on the geologic resource are anticipated because neither facility construction and operation activity nor site infrastructure improvements will restrict access to potential geologic resources. Design of the facilities would ensure that they would not be affected by potentially hazardous geologic conditions.

Construction activities will occur completely on previously disturbed land, as described in Section 4.2.3.1, and involve land disturbance of approximately 9 ha (22 acres). Soil disturbance would occur primarily from ground-

disturbing construction activities (foundation preparation) and activities associated with building construction laydown areas that can expose the soil profile and lead to a possible increase in soil erosion as a result of wind and water action. Soil loss would depend on the frequency and severity of rain, wind velocities (increases in wind velocity and duration increase potential soil erosion), and the size, location, and duration of ground-disturbing activities.

Net soil disturbance during operations would be considerably less than during construction because areas temporarily used for construction laydown would be restored. Although stormwater runoff and wind action could occur during operation, they are anticipated to be minimal. [Text deleted.]

Upgrade With All or Some Rocky Flats Environmental Technology Site Plutonium and Los Alamos National Laboratory Plutonium Subalternative

Modify Existing and Construct New Argonne National Laboratory-West Facilities for Continued Plutonium Storage

Construction and operation effects on geological and soil resources would be the same as those discussed previously for the upgrade without RFETS or LANL Pu Subalternative, because the inclusion or exclusion of RFETS and LANL Pu material would not change the amount of land disturbed during construction.

Consolidation Alternative

Construct New Plutonium Storage Facility

No apparent direct or indirect effects on the geologic resources are anticipated, because neither facility construction and operational activities nor site infrastructure improvements will limit access to potential geologic resources.

[Text deleted.] Additional soil impacts would be expected from the construction of the storage facility, which will occur completely on undisturbed land, as described in Section 4.2.3.1. Approximately 58.5 ha (144 acres) would be disturbed for the Consolidation Alternative, affecting the soil profile and leading to a possible increase in erosion. Analysis in this section is the same as that provided for the Upgrade Alternative.

Collocation Alternative

Construct New Plutonium and Highly Enriched Uranium Storage Facilities

No apparent direct or indirect effects on the geologic resource are anticipated, because neither facility construction and operational activities nor site infrastructure improvements will restrict access to potential geologic resources.

[Text deleted.] Construction of the storage facilities would occur on undisturbed land as described in Section 4.2.3.1. However, additional soil impacts would be anticipated because this alternative has the largest construction and land use requirements. During construction, approximately 89.5 ha (221 acres) would be disturbed for the new facilities, affecting the soil profile and leading to a possible temporary increase in erosion as a result of stormwater runoff and wind action. Soil impacts during operation are expected to be minimal. Analysis in this section is the same as that provided for the Upgrade Alternative.

Subalternative Not Including Strategic Reserve and Weapons Research and Development Materials

Exclusion of strategic reserve and weapons R&D materials would give almost the same effects to the soil resources for the No Action Alternative, the Upgrade Alternative, the Consolidation Alternative, and the Collocation Alternative. By excluding these materials the size of a facility would be similar, thus not changing the amount of land disturbed by construction activities. No effect to the geologic resource is anticipated as a result of this subalternative.

Phaseout

The phaseout of storage capacity would have no apparent effects on the geologic resources. However, phaseout could result in beneficial effects on the soils of the area. Hazardous, radioactive, and mixed waste sources would be eliminated from the area, thus decreasing the potential for future soil contamination.

[Text deleted.]

4.2.3.6 Biological Resources

Preferred Alternative: No Action Alternative

Under this alternative, the Pu storage mission described in Section 2.2.3 would continue at INEL. These activities would result in no appreciable change to current conditions of biological resources at INEL, as described in Section 3.4.6.

Upgrade Alternative

Upgrade Without Rocky Flats Environmental Technology Site Plutonium or Los Alamos National Laboratory Plutonium Subalternative

Modify Existing and Construct New Argonne National Laboratory–West Facilities for Continued Plutonium Storage

Upgrading existing Pu storage facilities at the ANL-W area of INEL would cause minimal disturbance to biological resources. This is because all activities, including some new construction, would take place within an area that is currently disturbed. Noise associated with construction could cause some temporary disturbance to wildlife, but this impact would be minimal since animals living adjacent to the current facility would have already adapted to its presence. Impacts on wetlands and aquatic resources would not occur since these resources are not found in the upgrade area, and all discharges would be to existing evaporation ponds. Since the upgrade would take place within a developed area, impacts on threatened and endangered species would not be expected.

Upgrade With All or Some Rocky Flats Environmental Technology Site Plutonium and Los Alamos National Laboratory Plutonium Subalternative

Modify Existing and Construct New Argonne National Laboratory–West Facilities for Continued Plutonium Storage

Upgrading with all or some of the RFETS and LANL materials stored at INEL would not be expected to change impacts on biological resources from those described for the Upgrade without RFETS Pu or LANL Pu Subalternative.

Consolidation Alternative

Construct New Plutonium Storage Facility

Under this alternative, Pu reserves would be consolidated in a new storage facility at INEL. Impacts on terrestrial resources, wetlands, aquatic resources, and threatened and endangered species are discussed below.

Terrestrial Resources. Construction of the Consolidated Pu storage facility would result in the disturbance of 58.5 ha (144 acres) of terrestrial resources, or less than 0.03 percent of INEL. This includes areas on which plant facilities would be constructed, as well as areas revegetated following construction. Vegetation within the proposed site would be destroyed during land-clearing operations. Big sagebrush is the dominant plant within the proposed site. Plant communities in which big sagebrush is the dominant overstory species are well represented on INEL, but they are relatively uncommon regionally because of widespread conversion of shrub-steppe habitats to agriculture.

Construction of the Pu storage facility would affect animal populations. Less-mobile animals within the project area, such as reptiles and small mammals, would not be expected to survive. Construction activities and noise

would cause larger mammals and birds in the construction and adjacent areas to move to similar habitat nearby. If the area to which they moved was below its carrying capacity, these animals would be expected to survive. However, if the area was already supporting the maximum number of individuals, the additional animals would compete for limited resources, which could lead to habitat degradation and eventual loss of the excess population. Because pronghorn use of the proposed site is relatively low, the facility should not have a lasting impact on these species. Nests and young animals living within the proposed site may not survive. The site would be surveyed as necessary for the nests of migrating birds prior to construction. Areas disturbed by construction but not occupied by facility structures would be of minimal value to wildlife because they would be maintained as landscaped areas.

Activities associated with facility operations, such as noise and human activity, could affect wildlife living immediately adjacent to the Pu storage facility. These disturbances may cause some species to move from the area. Disturbance to wildlife living adjacent to the facility would be minimized by preventing workers from entering undisturbed areas. Impacts on vegetation from salt drift would not occur since dry cooling systems would be used.

Wetlands. Construction and operation of the Pu storage facility would not affect wetlands since there are no wetlands on the proposed site. Wetlands associated with the Big Lost River are located 2.4 km (1.5 mi) from the site, so impacts on these wetlands are not expected.

Aquatic Resources. Construction and operation of the Pu storage facility would not affect aquatic resources since there are no surface water bodies on the proposed site. The nearest surface water body is in the Big Lost River, which is located 2.4 km (1.5 mi) from the site. Temporary aquatic habitat may develop in evaporation and retention ponds, as well as in natural channels in the immediate vicinity of NPDES-permitted outfalls.

Threatened and Endangered Species. It is unlikely that federally listed threatened or endangered species would be affected by construction of the Pu storage facility on INEL, but several State-status species may be affected. Up to 58.5 ha (144 acres) of habitat would be lost. Burrows and foraging habitat for the pygmy rabbit would be lost. Bat species such as the Townsend's western big-eared bat may roost in caves and forage throughout the proposed site. One State-listed sensitive plant species could potentially be affected by construction of the facility. The plant species, treelike oxytheca, has been collected at eight sites on INEL and at only two other sites in Idaho (IN DOE 1984a:34,36). If present, individual plants of this species could be destroyed during land-clearing activities. Preactivity surveys would be conducted as appropriate prior to construction to determine the presence of these species in the area to be disturbed. Consultation with USFWS and State agencies would be conducted at the site-specific level, as appropriate.

During operation of the new facilities, several bat species could forage at evaporation and stormwater retention ponds. No impacts on threatened and endangered species are expected due to facility operation.

Collocation Alternative

Construct New Plutonium and Highly Enriched Uranium Storage Facilities

Under this alternative, consolidated Pu reserves would be stored with HEU inventories in a new collocated storage facility(s) at INEL. Construction and operation of collocated storage facilities at INEL would have effects on biological resources similar to, but somewhat greater than, those described for the consolidated storage facility. Construction of the collocated storage alternative would disturb 89.5 ha (221 acres) of habitat.

Subalternative Not Including Strategic Reserve and Weapons Research and Development Materials

The exclusion of strategic reserve and weapons R&D materials would have almost the same effects to the Upgrade With All or Some RFETS and LANL Pu Subalternative, the Consolidation Alternative, and the

Collocation Alternative. The size of the facility would be similar and would not reduce the amount of habitat disturbance, and the potential impacts on biological resources would be similar. [Text deleted.]

Phaseout

The phaseout of Pu storage facilities at INEL would not be expected to affect biological resources, although increased human activity could temporarily disturb some wildlife species in the vicinity of the site.

4.2.3.7 Cultural and Paleontological Resources

Preferred Alternative: No Action Alternative

Under this alternative, DOE would continue the existing and planned missions at INEL, which include continued storage of Pu material at ANL-W within the ZPPR and FMF vaults in stabilized form pursuant to DNFSB Recommendation 94-1. Management of INEL's cultural resources is done within the framework of the *INEL Draft Management Plan for Cultural Resources* (DOE/ID-10361, July 1995). Any impacts on cultural or paleontological resources from these missions would be independent of the proposed action and would be addressed through separate NHPA, *American Indian Religious Freedom Act*, and *Native American Graves Protection and Repatriation Act* regulatory compliance procedures.

Upgrade Alternative

Upgrade Without Rocky Flats Environmental Technology Site Plutonium or Los Alamos National Laboratory Plutonium Subalternative

Modify Existing and Construct New Argonne National Laboratory–West Facilities for Continued Plutonium Storage

The new ANL-W facility is the proposed storage area under this alternative. This option involves new construction and modification of buildings 704, 774, and 775. [Text deleted.] Most of the land required for construction and operation has already been disturbed. Surface surveys have been conducted in some of the areas to be affected. In accordance with INEL's *Draft Management Plan for Cultural Resources*, surveys would be conducted in unsurveyed areas prior to construction. Discovery of any archaeological materials during construction would result in a work stoppage. Prehistoric site types that are known to occur at INEL include campsites, lithic workshops, cairns, and hunting blinds. Remains of small homesteads, sheep and cattle camps, stage and wagon trails, and abandoned towns comprise the historic component of archaeological resources at INEL. Any number of these may occur in areas slated for development. In addition, all of the facilities at INEL are considered potentially eligible for listing on the NRHP. Most have not yet been formally evaluated. These properties are managed within a framework established by DOE, the Idaho SHPO, and the Advisory Council on Historic Preservation.

Some Native American resources, such as archaeological sites and traditionally used plant and animal species, may be affected by construction of new facilities. Operation may affect other resources in the form of reduced access to traditional use areas and visual or auditory impact to sacred sites. The entire INEL site is considered sacred land to the Shoshone Bannock Tribe. DOE has established a Working Agreement with this group and consultation with them may identify resources that may be affected by the proposed alternative.

Although surface exposures of fossiliferous formations do not exist in the proposed location, ground-breaking construction could affect some paleontological resources. There are 31 known fossil localities at INEL, and more may exist. These materials sometimes occur in association with prehistoric archaeological sites and have high research potential.

Upgrade With All or Some Rocky Flats Environmental Technology Site Plutonium and Los Alamos National Laboratory Plutonium Subalternative

Modify Existing and Construct New Argonne National Laboratory–West Facilities for Continued Plutonium Storage

Land requirements during construction and operation would not change under this subalternative. Impacts on cultural and paleontological resources with all or some RFETS and LANL material would be the same as described in the Upgrade Without RFETS Pu or LANL Pu Subalternative.

Consolidation Alternative

Construct New Plutonium Storage Facility

A consolidated special nuclear material storage plant would be constructed southeast of the Big Lost River and ICPP. Land disturbance during construction would total approximately 58.5 ha (144 acres), and the operational land disturbance would be 56 ha (138 acres). A reduced-access buffer zone would exist around the facility. Five km (3 mi) of new road or railway may be necessary under this alternative. [Text deleted.] Impacts on cultural and paleontological resources that may result from facility construction and operation under this alternative are similar to those that would occur under the Upgrade Alternative, even though the location is different.

Collocation Alternative

Construct New Plutonium and Highly Enriched Uranium Storage Facilities

The area disturbed during construction would be 89.5 ha (221 acres), and new facilities would be collocated with the consolidated special nuclear material storage plant. The total operational land requirement would be 87 ha (215 acres). A reduced-access buffer zone would be created around the new facilities. [Text deleted.] Impacts on cultural and paleontological resources that may result from construction and operation under this alternative are similar to those discussed under the Upgrade Alternative, even though the locations differ.

Subalternative Not Including Strategic Reserve and Weapons Research and Development Materials

Under this subalternative, facility and other resource requirements would be almost the same as the Upgrade With All or Some RFETS Pu and LANL Pu Subalternative, the Consolidation Alternative, and the Collocation Alternative. Therefore, impacts on cultural and paleontological resources would be equal to those previously discussed. [Text deleted.]

Phaseout

For this activity, all the Pu materials at INEL within the scope of this PEIS would be transferred to another site, and the storage mission would be phased out. Impacts on prehistoric resources are not anticipated because phaseout is not expected to result in ground-breaking activity. Likewise, no impacts on paleontological remains are expected. It may affect, through alteration, if subsequently proposed, some NRHP-eligible historic structures at INEL. Impacts on Native American resources are not expected.

[Text deleted.]

4.2.3.8 Socioeconomics

Preferred Alternative: No Action Alternative

Regional Economy Characteristics. Total employment in the REA is projected to increase approximately 2 percent annually between 1995 and 2000, reaching about 152,600 in the latter year. Long-term projections indicate slower growth after the year 2000, when employment would increase about 1 percent annually and reach approximately 202,500 in 2040. Unemployment in the REA was 5.4 percent in 1994 and is expected to remain at this level into the near future. Per capita income is projected to increase from approximately \$17,701 in 1995 to \$24,177 in 2040. Projections for the No Action Alternative are presented in Table L.1–28.

Population and Housing. Population in the ROI is projected to increase from approximately 215,300 in 1995 to 304,500 by 2040. The total number of housing units in the ROI is projected to increase from about 74,600 in 1995 to 105,600 in 2040. Population and housing projections for the No Action alternative are presented in Tables L.1–29 and L.1–30, respectively.

Community Services. Education, public safety, and health care characteristics are used to assess the level of community services in the INEL ROI. School enrollments are projected to increase from about 53,460 students in 1995 to 75,630 students by 2040. The current student-to-teacher ratio is 18.5:1. To maintain this service level, the number of teachers in the ROI would need to increase from approximately 2,890 in 1995 to 4,084 in 2040. These projections are presented in Tables L.1–31 and L.1–32.

The projected numbers of sworn police officers and firefighters serving in ROI communities over the period 1995 to 2040 are shown in Tables L.1–33 and L.1–34, respectively. Under No Action, the number of sworn police officers is projected to increase from approximately 344 in 1995 to 487 in 2040 to maintain the current service level of 1.6 sworn officers per 1,000 persons. The number of firefighters in the ROI would need to increase from about 465 in 1995 to 657 in 2040 to maintain the present service level of 2.2 firefighters per 1,000 persons.

Hospital occupancy rates are based on current capacity. These rates and the estimated number of physicians serving the ROI population between 1995 and 2040 are presented in Tables L.1–35 and L.1–36, respectively. Hospital occupancy rates are projected to increase from approximately 51 percent in 1995 to 72 percent in 2040. To maintain the current physician-to-population ratio of 1.2 physicians per 1,000 persons, the total number of physicians in the ROI would need to increase from approximately 267 in 1995 to 378 in 2040.

Local Transportation. Any increases in traffic would be due to projected growth in the area unrelated to DOE activities. [Text deleted.]

Upgrade Alternative

Upgrade Without Rocky Flats Environmental Technology Site Plutonium or Los Alamos National Laboratory Plutonium Subalternative

Modify Existing and Construct New Argonne National Laboratory–West Facilities for Continued Plutonium Storage

Upgrading existing Pu storage facilities at INEL, without RFETS or LANL material, would create minimal changes within the region. Construction of the facility would require 122 workers, and 81 new employees would be needed to operate the upgraded facility. There would be sufficient labor available in the REA to fill both direct and indirect jobs created from this subalternative. Therefore, no workers would in-migrate to the region and no change to the region's population would result beyond No Action projections.

Regional Economy Characteristics. Construction would generate a total of 248 jobs (122 direct and 126 indirect). Operation would generate a total of 298 jobs (81 direct and 217 indirect). [Text deleted.] Total employment would increase by much less than 1 percent during both construction and operation of the facility. Unemployment would decline from 5.4 percent to 5.2 percent during both construction and operation. Per capita income would increase by much less than 1 percent over the No Action Alternative during both phases (Socio 1996a).

Population, Housing, and Community Services. All newly created employment would be filled by the resident labor force. Therefore, there would be no change to the region's population beyond the No Action level. Accordingly, there would be minimal impacts on the housing sector or community services as a result of the construction and operation of this facility.

Local Transportation. A total of 234 and 156 vehicle trips per day would be generated during the construction and operation phases, respectively. There would be no significant impacts to the local road network during either phase (Socio 1996a).

Upgrade With All or Some Rocky Flats Environmental Technology Site Plutonium and Los Alamos National Laboratory Plutonium Subalternative

Modify Existing and Construct New Argonne National Laboratory–West Facilities for Continued Plutonium Storage

Under this option, all or a portion of the RFETS and LANL material would be transferred to INEL. Depending on the modifications required at INEL, between 122 and 144 onsite workers would be employed during construction of the facility. An additional 126 to 148 indirect jobs would also be generated. There would be sufficient available labor in the REA to fill both direct and indirect jobs generated as a result of construction of the upgraded facility. Because constructing a storage facility to include all of the RFETS and LANL material would require at maximum only 22 more workers than a facility that would include none of the material, socioeconomic impacts would be similar to those for the Upgrade Without RFETS Pu or LANL Pu Subalternative.

During the operation phase, 116 workers would be employed if all of the RFETS and LANL material was stored at INEL. However, 35 of these positions would be filled by existing INEL employees. Therefore, only 81 new positions would be created for the operation of the upgraded facility with RFETS and LANL material, which is the same number of personnel required for upgrade without RFETS or LANL material. Therefore, the magnitude of socioeconomic effects for this subalternative would be the same as those discussed above for the Upgrade Without RFETS Pu or LANL Pu Subalternative.

Consolidation Alternative

Construct New Plutonium Storage Facility

To consolidate storage of Pu currently stored at multiple DOE sites, a new storage facility would need to be constructed at INEL. Workers would in-migrate to fill a portion of the direct jobs created during construction and operation of this facility.

Regional Economy Characteristics. Construction would generate a total of 2,237 jobs (1,102 direct and 1,135 indirect). Operation would generate a total of 1,591 jobs (432 direct and 1,159 indirect). Total employment would increase slightly more than 1 percent for construction and approximately 1 percent for operation over No Action projections. Unemployment would decrease to 4.4 percent during construction and 4.5 percent during operation. Per capita income is projected to increase by less than 1 percent for construction and operation (Socio 1996a).

Population and Housing. The in-migration of workers during the construction and operation periods would increase the ROI population by less than 1 percent over No Action projections. The largest increase would occur during construction. Some new housing may be needed. However, expected vacancies and historic housing construction rates indicate that housing would be available to accommodate the population growth (Socio 1996a).

Community Services. The ROI population growth would slightly increase the demand for some community services. Worker in-migration would lead to an increase in ROI school enrollments by about 423 students during construction and 35 students during operation. To maintain the No Action student-to-teacher ratio of 18.5:1, the number of teachers would have to increase by 23 during the construction period and only two during operation (Socio 1996a). Since this additional need for teachers would be distributed over the various jurisdictions in the ROI, the effect on any single school district would be minimal.

To maintain current levels of service, only three police officers and four firefighters would need to be hired during the construction period. No additional police officers or firefighters would be required to maintain current service levels during operation (Socio 1996a).

The small population change would have a negligible effect on health services, increasing hospital occupancy by much less than 1 percent during construction and operation. The number of physicians in the ROI would need to increase by only two during construction to maintain the current service level. No additional physicians would be needed during operation (Socio 1996a).

Local Transportation. A total of 2,116 and 829 vehicle trips per day would be generated during the construction and operation phases, respectively. Construction would cause a drop in the level of service on U.S. 20/26 from U.S. 26 East to State Route 22/33. U.S. 20/26 level of service would change from B to C. Traffic generated from facility operations would not affect the level of service on the local road segments analyzed (Socio 1996a).

Collocation Alternative

Construct New Plutonium and Highly Enriched Uranium Storage Facilities

To collocate storage of Pu and HEU that is currently stored at multiple DOE sites, a new storage facility would need to be constructed at INEL. Workers would in-migrate to fill a portion of the direct jobs created during construction and operation of this facility.

Regional Economy Characteristics. Construction would generate a total of 2,932 jobs (1,444 direct and 1,488 indirect). Operation would generate a total of 2,066 jobs (561 direct and 1,505 indirect). Total employment would increase by about 2 percent for construction and slightly more than 1 percent for operation over No Action projections. Unemployment would decrease to 4.2 percent during construction and operation. Per capita income is projected to increase by less than 1 percent during construction and by about 1 percent during operation (Socio 1996a).

Population and Housing. The in-migration of workers during the construction and operation periods would increase the ROI population by slightly more than 1 percent and much less than 1 percent over No Action projections, respectively. The largest growth would occur during construction. Some new housing may be needed. However, expected vacancies and historic housing construction rates indicate that housing would be available to accommodate the population growth (Socio 1996a).

Community Services. The additional population would slightly increase the demand for some community services. Worker in-migration would lead to an increase in ROI school enrollments by about 646 students during construction and 82 students during operation. To maintain the No Action student-to-teacher ratio of 18.5:1, the

number of teachers would have to increase by 35 during the construction period and by 4 during operation (Socio 1996a). Since this additional need for teachers would be distributed over the various jurisdictions in the ROI, the effect on any single school district would be minimal.

To maintain No Action levels of service, four police officers and six firefighters would need to be hired during the construction period. Only one additional police officer and firefighter would be required to maintain current service levels during operation (Socio 1996a).

The small population increase would have a negligible effect on health services, increasing hospital occupancy by much less than 1 percent during construction and operation. The number of physicians in the ROI would need to increase by four during peak construction to maintain the No Action level of service. No additional physicians would be needed during operation (Socio 1996a).

Local Transportation. A total of 2,772 and 1,077 vehicle trips per day would be generated during the construction and operation phases, respectively. Traffic generated during construction would cause a drop in the level of service on U.S. 20 from U.S. 26/91 at Idaho Falls to U.S. 26 East. The level of service would change from D to E. The level of service on U.S. 20/26 from U.S. 26 East to ID 22/33 would change from B to C. Traffic generated from facility operations would not affect the level of service on the local road segments analyzed (Socio 1996a).

Subalternative Not Including Strategic Reserve and Weapons Research and Development Materials

The requirements for each storage option considered would decrease slightly if strategic reserve and weapons R&D materials were not included for storage at INEL. This should result in a decrease in the number of required operation employees for each of the considered alternatives. Therefore, socioeconomic effects on the REA/ROI for the storage alternatives with no strategic reserve and weapons R&D materials should be equal to, or somewhat less than, the Upgrade with All or Some RFETS and LANL Pu Subalternative, the Consolidation Alternative, and the Collocation Alternative. [Text deleted.]

Phaseout

Phasing out Pu storage at INEL would result in no loss of jobs in the REA. Only four to five workers are employed in this storage area, and they would be relocated to other areas. Thus, the socioeconomic effects for the phaseout alternative would be the same as discussed under No Action.

4.2.3.9 Public and Occupational Health and Safety

The assessments of potential radiological and chemical impacts associated with the storage alternatives at INEL are presented in this section. Summaries of radiological impacts from normal operations are presented in Tables 4.2.3.9-1 and 4.2.3.9-2 for the public and workers, respectively. Impacts from hazardous chemicals are presented in Table 4.2.3.9-3. Summaries of impacts associated with postulated accidents are given in Tables 4.2.3.9-4 through 4.2.3.9-7. Detailed results are presented in Appendix M.

Preferred Alternative: No Action Alternative

This section describes the radiological and hazardous chemical releases and their associated impacts resulting from normal operations involved with the sitewide INEL missions, including interim storage of Pu. The impacts would be within applicable regulatory limits. For facility accidents, the risks and consequences are described in site safety documentation.

Normal Operation. The current mission at INEL, where Pu is in interim storage, is described in Section 3.4. The site has identified those facilities that will continue to operate under the No Action Alternative, including interim Pu storage facilities and others, if any, that will become operational by 2005. Based on that information, the radiological and chemical releases to the environment in 2005 and beyond (future operation) were developed and used in the impact assessments. The resulting doses and potential health effects on the public and workers at INEL are described below.

Under No Action Alternative, weapons-usable Pu material at ANL-W would continue to be stored in the material forms deemed most stable according to the ANL-W Plutonium ES&H Vulnerability Assessment Plan (October 31, 1994).

Radiological Impacts. The calculated annual dose to the average and maximally exposed members of the public from total site operation; the associated fatal cancer risks to these individuals from 50 years of operation; the dose to the population within 80 km (50 mi) from total site operation in the year 2030; and the projected number of fatal cancers in this population from 50 years of operation are presented in Table 4.2.3.9-1 under this alternative at INEL. The annual dose of 0.018 mrem to the MEI is within the radiological limits specified in NESHAPS (40 CFR 61, Subpart H) and DOE Order 5400.5. From 50 years of operation, the corresponding risk of fatal cancer to this individual would be 4.4×10^{-7} . This activity would be included in a program to ensure that doses to the public are ALARA. The annual dose of 2.4 person-rem to the population would be within the limit in proposed 10 CFR 834. The corresponding number of fatal cancers in this population from 50 years of operation would be 0.061. To put operational doses into perspective, comparisons with doses from natural background radiation are included in the table.

Under the No Action Alternative, shown in Table 4.2.3.9-2, the annual average dose to a noninvolved (No Action) site worker and the annual dose to the noninvolved (No Action) total site workforce would be 30 mrem and 220 person-rem, respectively, for total site operations. The associated risk of fatal cancer to the average worker from 50 years of total site operations would be 6.0×10^{-4} and the projected number of fatal cancers among all workers from 50 years of total size operations would be 4.4.

The average annual average dose to a worker involved in the No Action storage operations would be 26 mrem/yr with a total involved No Action workforce dose of 1.5 person-rem. The associated risk of latent fatal cancer to the average No Action involved worker from 50 years of operation would be 5.1×10^{-4} and the projected number of latent fatal cancers among the No Action involved workforce from 50 years of operation would be 0.029.

Hazardous Chemical Impacts. Hazardous chemical impacts on the public resulting from the normal operation under No Action at INEL are presented in Table 4.2.3.9-3. The hazardous chemical impacts from current site

operations represent the baseline total site impacts for the various storage alternatives. The noncancer health effects expected and the risk of cancer due to the total chemical exposures were estimated for each site. Since the major releases due to normal operation at INEL would make up nearly all of the exposures to onsite workers and to the public in adjacent communities, contributions to the hazardous chemical concentrations from all other sources (for example, industrial operations) are considered negligible for purposes of risk calculations.

The HI to the MEI of the public at INEL resulting from normal operation under the No Action Alternative is 1.5×10^{-2} , and the cancer risk is 3.6×10^{-6} . The HI to the onsite worker is 0.22, and the cancer risk is 7.7×10^{-4} .

Facility Accidents. Under the No Action alternative, Pu would continue to be stored at INEL in existing facilities. These facilities currently operate in accordance with DOE Orders, which ensure that the risk to the public of prompt fatalities due to accidents or cancer fatalities due to operations will be minimized. The safety to workers and the public from accidents at existing facilities is also controlled by Technical Safety Requirements specified in detail in SARs or a Basis for Interim Operations document prepared and maintained specifically for a facility or process within a facility. Under these controls, any change in approved operations or to facilities would cause a halt in operations until it can be established that worker and public safety has not been compromised.

The *Final Safety Analysis Report for the Fuel Manufacturing Facility, Building 704* (ANL-IFR-57) and the *Final Safety Analysis Report of the Zero Power Plutonium Reactor Facility* (ANL-7471) at ANL-W analyzed a wide spectrum of design-basis accidents. These studies indicate that these facilities are low hazard based on the effects of design-basis accidents. However, these studies do not normally analyze the effects of severe accidents. An estimate of the effects of potential severe accidents in the existing storage vault at INEL can be derived from similar storage accidents that have been postulated for an upgraded storage facility. A severe consequence, low frequency accident for storage under the No Action Alternative would be a beyond design basis earthquake. If this accident were to occur, there would be an estimated 0.33 cancer fatalities in the offsite population within 80 km (50 mi). The estimated frequency of the earthquake with sufficient damage to cause a release is approximately 1.0×10^{-7} per year, which corresponds to a risk of 3.3×10^{-8} cancer fatalities per year. For the MEI and noninvolved worker, the corresponding impacts are 9.8×10^{-4} and 0.02 latent cancer fatalities, respectively, if the accident occurred. The risks would be 9.8×10^{-11} and 2.0×10^{-9} cancer fatalities per year. A potentially more frequent accident is penetration of the PCV caused by corrosion. If this accident were to occur, the estimated number of cancer fatalities in the offsite population would be 5.1×10^{-4} . The estimated frequency of this accident is 0.064 per year, which corresponds to a risk to the offsite population of 3.3×10^{-5} cancer fatalities per year. For the MEI and noninvolved worker the corresponding impacts are 1.6×10^{-6} and 2.3×10^{-5} latent cancer fatalities, respectively, if the accident occurred. The risks would be 1.0×10^{-7} and 1.5×10^{-6} cancer fatalities per year.

Upgrade Alternative

Upgrade Without Rocky Flats Environmental Technology Site Plutonium or Los Alamos National Laboratory Plutonium Subalternative

Modify Existing and Construct New Argonne National Laboratory–West Facilities for Continued Plutonium Storage

This section describes the radiological and hazardous chemical releases and their associated impacts resulting from either normal operation or accidents involved with the upgraded Pu storage alternative at INEL. The section describes the impacts from normal facility operations at INEL; this is followed by a description of impacts from facility accidents.

[Text deleted.]

Normal Operation. There would be no radiological releases during the modification or construction of storage facilities at INEL. Construction worker exposures to materials potentially contaminated with radioactivity (for example, from construction activities involved with existing contaminated soil) would be limited to assure that doses are maintained ALARA. Toward this end, construction workers would be monitored as appropriate. Limited hazardous chemical releases are anticipated as a result of the construction activities. However, concentrations would be within the regulated exposure limits. During normal operation, there would be both radiological and hazardous chemical releases to the environment and also direct exposures. The resulting doses and potential health effects on the public and workers at INEL are described below.

Radiological Impacts. Doses to the public from storage under the Upgrade Alternative are included in Table 4.2.3.9-1. Because facility and design features would improve under the Upgrade Alternative, these doses and resulting fatal cancers are surmised to be even smaller than those associated with storage under the No Action alternative. The dose to the MEI of the public due to annual operations under the Upgrade Alternative would be 5.1×10^{-7} mrem. From 50 years of operation, the corresponding risk of fatal cancer to this individual would be 1.3×10^{-11} . The impacts to the average individual would be less. As a result of operation under this alternative in the year 2030, the population dose would be 3.2×10^{-6} person-rem. The corresponding number of fatal cancers in this population due to 50 years of operation would be 7.2×10^{-8} .

The dose to the MEI from annual total site operations is within the radiological limits specified in NESHAPS (40 CFR 61, Subpart H) and DOE Order 5400.5, and would be 0.018 mrem. From 50 years of operations, the corresponding risk of fatal cancer to this individual would be 4.4×10^{-7} . These values are presented in Table 4.2.3.9-1. The impacts on the average individual would be less. This activity would be included in a program to ensure that doses to the public are ALARA. As a result of total site operations in the year 2030, the population dose would be within the limit in proposed 10 CFR 834 and would be 2.4 person-rem. The corresponding number of fatal cancers in this population from 50 years of operation would be 0.061.

Doses to onsite workers from normal operations are given in Table 4.2.3.9-2. Included are involved workers directly associated with upgraded storage, workers who are not involved with the storage facilities, and the entire workforce at INEL. All doses fall within regulatory limits and administrative control levels. The associated risks and numbers of fatal cancers among the different workers from 50 years of operations are included in the table. Dose to individual workers would be kept low by instituting badged monitoring and ALARA programs and also workers rotations. As a result of the implementation of these mitigation measures, the actual number of fatal cancers calculated would be lower for the operation of this facility.

Hazardous Chemical Impacts. Hazardous chemical impacts on the public and on the onsite worker resulting from the normal operations of the upgraded storage facilities at INEL are presented in Table 4.2.3.9-3. The impacts from total site operations, including the upgraded storage facilities, are also included in this table. Total site impacts, which include the No Action impact plus the storage impacts, are provided. All analyses to support the values presented in this table are provided in Section M.3.

The HI to the MEI of the public is 1.2×10^{-5} , and the cancer risk is 5.9×10^{-8} as a result of operation of the upgraded storage facilities in the year 2030. The HI and cancer risk would remain constant over 50 years of operation because exposures would be expected to remain the same. The total site operation, including the storage facilities, would result in an HI of 1.5×10^{-2} and a cancer risk of 3.7×10^{-6} for the onsite worker in the year 2030. This would be expected to remain constant as a result of 50 years of operation.

The HI to the onsite worker would be 3.7×10^{-4} , and the cancer risk is 1.2×10^{-5} as a result of operation of the upgraded storage facilities in the year 2030. The HI and cancer risk would remain constant over 50 years of operation because exposures are expected to remain the same. The total site operation, including the storage facilities, would result in an HI of 0.22 and a cancer risk of 7.8×10^{-4} for the onsite worker in the year 2030. This would be expected to remain constant as a result of 50 years of operation.

Facility Accidents. Modification of the existing Pu storage facilities at INEL may change the existing risks of accidents to workers and the public. ANL-W facilities would be modified and would be in compliance with DOE orders and other applicable regulations and standards. This may result in a reduction of risk compared to No Action.

A set of potential accidents have been postulated for upgraded existing storage facility for which there may be releases of Pu that may impact onsite workers and the offsite population. The impacts of potential accidents and the release of Pu would be dominated by the impacts associated with exposure to Pu. The accident consequences and risks to a worker located 1,000 m (3,280 ft) from the accident release point, the maximum offsite individual located at the site boundary, and the population located within 80 km (50 mi) of the accident release point are summarized in Table 4.2.3.9–4. For the set of accidents analyzed, the maximum number of cancer fatalities in the population within 80 km (50 mi) would be 0.33 at INEL for the beyond design basis earthquake accident scenario with an estimated probability of 1.0×10^{-7} per year (that is, probability of severe earthquake occurring is estimated to be about 1.0×10^{-5} , once in 100,000 years, multiplied by a damage and release probability of 0.01). The corresponding 50-year facility lifetime risk from the same accident scenario for the population, maximum offsite individual, and worker at 1,000 m (3,280 ft), would be 1.6×10^{-6} , 4.9×10^{-9} , and 1.0×10^{-7} , respectively. The maximum population 50-year facility lifetime risk would be 1.6×10^{-3} (for example, one fatality in about 31,500 years) at INEL for the PCV penetration by corrosion accident scenario with a probability of 0.064 per year. The corresponding maximum offsite individual and worker 50-year facility lifetime risks would be 5.0×10^{-6} and 7.5×10^{-5} , respectively. Section M.5 presents additional facility accident data and summary descriptions of the accident scenarios identified in Table 4.2.3.9–4.

During normal operation at INEL, operation under the upgraded Pu storage alternative would result in impacts that are within applicable regulatory limits. Involved workers, those that would work in the facilities associated with the proposed action, may be subject to injury and, in some cases, fatality as a result of potential accidents. The locations of workstations, number of workers, personnel protective features, engineered safety features, and other design details affect the extent of worker exposures to accidents. Certain accidents such as fires, explosions and criticality could cause fatalities to workers close to the accident. Prior to construction of a new or modification of an existing facility, DOE Orders require detailed safety analyses to assure that facility designs and operating procedures limit the number of workers in hazardous areas and minimize risk of injury or fatality in the event of an accident.

Upgrade With All or Some Rocky Flats Environmental Technology Site Plutonium and Los Alamos National Laboratory Plutonium Subalternative

Modify Existing and Construct New Argonne National Laboratory–West Facilities for Continued Plutonium Storage

Normal Operation. During normal operations, there would be only a negligible difference in radiological and hazardous chemical impacts if Pu from RFETS and LANL is included in the Upgrade Storage Alternative. Therefore, the impacts are essentially the same as presented in the previous subsection discussing the Upgrade Without RFETS or LANL Pu.

Facility Accidents. A set of potential accidents have been postulated for the incremental impacts for upgraded storage of LANL and RFETS Pu for which there may be releases of Pu that may impact onsite workers and the offsite population. The accident consequences and risks to a worker located 1,000 m (3,280 ft) from the accident release point, the maximum offsite individual located at the site boundary, and the general population located within 80 km (50 mi) of the accident release point are summarized in Table 4.2.3.9–5. For the set of accidents analyzed, the maximum number of cancer fatalities in the population within 80 km (50 mi) would be 0.037 at INEL for the beyond design basis earthquake accident scenario with an estimate probability of 1.0×10^{-7} per year (for example, probability of severe earthquake occurring is estimated to be about 1.0×10^{-5} , once in 100,000 years, multiplied by a damage and release probability of 0.01). The corresponding 50-year facility lifetime risk

Table 4.2.3.9-4. Upgrade Without Rocky Flats Environmental Technology Site or Los Alamos National Laboratory Material Alternative—Accident Impacts at Idaho National Engineering Laboratory

Accident Description	Worker at 1,000 m		Maximum Offsite Individual		Population to 80 km		
	Risk of Cancer Fatality (per 50 yr) ^a	Probability of Cancer Fatality ^b	Risk of Cancer Fatality (per 50 yr) ^a	Probability of Cancer Fatality ^b	Risk of Cancer Fatalities (per 50 yr) ^a	Number of Cancer Fatalities ^c	Accident Frequency (per yr)
PCV puncture by forklift	1.7×10^{-7}	5.6×10^{-6}	1.1×10^{-8}	3.8×10^{-7}	3.7×10^{-6}	1.2×10^{-4}	6.0×10^{-4}
PCV breach by firearms discharge	9.9×10^{-9}	5.6×10^{-7}	6.6×10^{-10}	3.8×10^{-8}	2.2×10^{-7}	1.2×10^{-5}	3.5×10^{-4}
PCV penetration by corrosion	7.5×10^{-5}	2.3×10^{-5}	5.0×10^{-6}	1.6×10^{-6}	1.6×10^{-3}	5.1×10^{-4}	0.064
Vault fire	6.5×10^{-8}	0.013	3.3×10^{-9}	6.6×10^{-4}	1.1×10^{-6}	0.22	1.0×10^{-7}
Truck bay fire	4.0×10^{-9}	8.0×10^{-4}	2.7×10^{-10}	5.4×10^{-5}	8.9×10^{-8}	0.018	1.0×10^{-7}
Spontaneous combustion	7.9×10^{-12}	1.1×10^{-6}	5.3×10^{-13}	7.5×10^{-8}	1.7×10^{-10}	2.5×10^{-5}	7.0×10^{-7}
Explosion in the vault	4.6×10^{-8}	9.1×10^{-3}	2.5×10^{-9}	4.9×10^{-4}	8.2×10^{-7}	0.16	1.0×10^{-7}
Explosion outside of vault	4.0×10^{-11}	8.0×10^{-6}	2.7×10^{-12}	5.4×10^{-7}	8.9×10^{-10}	1.8×10^{-4}	1.0×10^{-7}
Nuclear criticality	2.0×10^{-11}	4.0×10^{-6}	1.5×10^{-12}	3.0×10^{-7}	4.8×10^{-11}	9.6×10^{-6}	1.0×10^{-7}
Beyond evaluation basis earthquake	1.0×10^{-7}	0.020	4.9×10^{-9}	9.8×10^{-4}	1.6×10^{-6}	0.33	1.0×10^{-7}
Expected risk ^d	7.5×10^{-5}	—	5.0×10^{-6}	—	1.6×10^{-3}	—	—

^a The risk values are calculated by multiplying the probability of cancer fatality (for the worker at 1,000 m or the maximum offsite individual) or the number of cancer fatalities (for the population to 80 km) by the accident frequency and the number of years of operation.

^b Increased likelihood (or probability) of cancer fatality to a hypothetical individual (a single onsite worker at a distance of 1,000 m or the site boundary, whichever is smaller or to a hypothetical individual in the offsite population located at the site boundary) if exposed to the indicated dose. The value assumes the accident has occurred.

^c Estimated number of cancer fatalities in the entire offsite population out to a distance of 80 km if exposed to the indicated dose. The value assumes the accident has occurred.

^d Expected risk is the sum of the risks over the 50-year lifetime of the facility.

Note: All values are mean values.

Source: Calculated using the source terms in Tables M.5.2.1.1-5 and M.5.2.1.1-6 and the MACCS computer code.

from the same accident scenario for the population, maximum offsite individual, and worker at 1,000 m (3,280 ft), would be 1.8×10^{-7} , 8.6×10^{-11} , and 1.1×10^{-8} , respectively. The maximum population 50-year facility lifetime risk would be 1.3×10^{-4} (for example, one fatality in about 38,500 years) at INEL for the PCV penetration by corrosion accident scenario with a probability of 6.6×10^{-3} per year. The corresponding maximum offsite individual and worker 50-year facility lifetime risks would be 5.9×10^{-8} and 5.6×10^{-6} respectively. Section M.5 presents additional facility accident data and summary descriptions of the accident scenario identified in Table 4.2.3.9-5. Table 4.2.3.9-5 also shows the combined expected risk for storage of existing Pu and the RFETS and LANL materials.

During normal operation at INEL, operation under the upgraded Pu storage alternative would result in impacts that are within applicable regulatory limits. Involved workers, those that would work in the facilities associated with the proposed action, may be subject to injury and, in some cases, fatality as a result of potential accidents. The locations of workstations, number of workers, personnel protective features, engineered safety features, and other design details affect the extent of worker exposures to accidents. Certain accidents such as fires, explosions and criticality could cause fatalities to workers close to the accident. Prior to construction of a new or modification of an existing facility, DOE Orders require detailed safety analyses to assure that facility designs and operating procedures limit the number of workers in hazardous areas and minimize risk of injury or fatality in the event of an accident.

Table 4.2.3.9–5. Upgrade With Rocky Flats Environmental Technology Site and Los Alamos National Laboratory Material Alternative—Accident Impacts at Idaho National Engineering Laboratory

Accident Description	Worker at 1,000 m		Maximum Offsite Individual		Population to 80 km		Accident Frequency (per yr)
	Risk of Cancer Fatality (per 50 yr) ^a	Probability of Cancer Fatality ^b	Risk of Cancer Fatality (per 50 yr) ^a	Probability of Cancer Fatality ^b	Risk of Cancer Fatality (per 50 yr) ^a	Number of Cancer Fatalities ^c	
PCV puncture by forklift	1.2×10^{-7}	4.1×10^{-6}	1.3×10^{-9}	4.4×10^{-8}	2.9×10^{-6}	9.6×10^{-5}	6.0×10^{-4}
PCV breach by firearms discharge	7.2×10^{-9}	4.1×10^{-7}	7.8×10^{-11}	4.4×10^{-9}	1.7×10^{-7}	9.6×10^{-6}	3.5×10^{-4}
PCV penetration by corrosion	5.6×10^{-6}	1.7×10^{-5}	5.9×10^{-8}	1.8×10^{-7}	1.3×10^{-4}	3.9×10^{-4}	6.6×10^{-3}
Vault fire	5.8×10^{-9}	1.1×10^{-3}	4.8×10^{-11}	9.5×10^{-5}	1.0×10^{-7}	0.021	1.0×10^{-7}
Truck bay fire	2.9×10^{-9}	5.7×10^{-4}	3.1×10^{-11}	6.2×10^{-6}	6.7×10^{-8}	0.013	1.0×10^{-7}
Spontaneous combustion	2.9×10^{-11}	8.2×10^{-7}	3.1×10^{-13}	8.9×10^{-9}	6.7×10^{-10}	1.9×10^{-5}	7.0×10^{-7}
Explosion in the vault	6.9×10^{-10}	1.3×10^{-4}	7.5×10^{-12}	1.5×10^{-6}	1.6×10^{-8}	3.2×10^{-3}	1.0×10^{-7}
Explosion outside of vault	3.1×10^{-11}	6.2×10^{-6}	3.3×10^{-13}	6.7×10^{-8}	7.2×10^{-10}	1.4×10^{-4}	1.0×10^{-7}
Nuclear criticality	2.0×10^{-11}	4.0×10^{-6}	1.9×10^{-13}	3.9×10^{-8}	4.5×10^{-11}	8.9×10^{-6}	1.0×10^{-7}
Beyond evaluation basis earthquake	1.1×10^{-8}	2.2×10^{-3}	8.6×10^{-11}	1.7×10^{-5}	1.8×10^{-7}	0.037	1.0×10^{-7}
Expected risk ^d	5.6×10^{-6}	—	5.9×10^{-8}	—	1.3×10^{-4}	—	—
Combined expected risk ^e	8.1×10^{-5}	—	5.1×10^{-6}	—	1.7×10^{-3}	—	—

^a The risk values are calculated by multiplying the probability of cancer fatality (for the worker at 1,000 m or the maximum offsite individual) or the number of cancer fatalities (for the population to 80 km) by the accident frequency and the number of years of operation.

^b Increased likelihood (or probability) of cancer fatality to a hypothetical individual (a single onsite worker at a distance of 1,000 m or the site boundary, whichever is smaller or to a hypothetical individual in the offsite population located at the site boundary) if exposed to the indicated dose. The value assumes the accident has occurred.

^c Estimated number of cancer fatalities in the entire offsite population out to a distance of 80 km if exposed to the indicated dose. The value assumes the accident has occurred.

^d Expected risk is the sum of the incremental risks for the additional RFETS and LANL material over the lifetime of the plant.

^e Combined expected risk for upgrade of existing storage and RFETS and LANL storage.

Note: All values are mean values.

Source: Calculated using Table 4.2.3.9–6.

Consolidation Alternative

Construct New Plutonium Storage Facility

This section includes a description of radiological and hazardous chemical releases and their associated impacts resulting from either normal operation or accidents involved with the new consolidated Pu storage facility at INEL. Normal operation of the consolidated storage facility would result in impacts that are within applicable regulatory limits.

[Text deleted.]

Normal Operation. There would be no radiological releases during the construction of a new consolidated Pu storage facility at INEL. Construction worker exposures to material potentially contaminated with radioactivity (for example, from construction activities involved with existing contaminated soil) would be limited to assure that doses are maintained ALARA. Toward this end, construction workers would be monitored as appropriate. Limited hazardous chemical releases are anticipated as a result of construction activities. However,

concentrations would be within the regulated exposure limits. During normal operation, there would be both radiological and hazardous chemical releases to the environment and also direct in-plant exposures. The resulting doses and potential health effects on the public and workers at INEL are described below.

Radiological Impacts. Radiological impacts on the public resulting from the normal operation of the new consolidated storage facility are presented in Table 4.2.3.9–1. The impacts from all site operations, including the new consolidated Pu storage facility, are also given in the table. To put operational doses into perspective, comparisons with doses from natural background radiation are included in the table.

The dose to the MEI from annual storage facility operation would be 1.6×10^{-6} mrem. From 50 years of operation, the corresponding risk of fatal cancer to this individual would be 4.0×10^{-11} . The impacts on the average individual would be less. As a result of storage facility operation in the year 2030, the population dose would be 1.8×10^{-5} person-rem. The corresponding number of fatal cancers in this population from 50 years of operation would be 4.5×10^{-7} .

The dose to the MEI from annual total site operations is within the radiological limits specified in NESHAPS (40 CFR 61, Subpart H) and DOE Order 5400.5, and would be 0.018 mrem. From 50 years of operation, the corresponding risk of fatal cancer to this individual would be 4.4×10^{-7} . The impacts on the average individual would be less. This activity would be included in a program to ensure that doses to the public are ALARA. As a result of total site operation in the year 2030, the population dose would be within the limit in proposed 10 CFR 834 and would be 2.4 person-rem. The corresponding number of fatal cancers in this population from 50 years of operation would be 0.061.

Doses to onsite workers from normal operations are given in Table 4.2.3.9–2. Included are involved workers directly associated with the new consolidated storage facility, workers who are not involved with the new storage facility, and the entire workforce at INEL. All doses fall within regulatory limits and administrative control levels. The associated risks and numbers of fatal cancers among the different workers from 50 years of operation are included in the table. Dose to individual workers would be kept low by instituting badged monitoring and ALARA programs and also workers rotations. As a result of the implementation of these mitigation measures, the actual number of fatal cancers calculated would be lower for the operation of this facility.

Hazardous Chemical Impacts. Hazardous chemical impacts on the public and on the onsite worker resulting from the normal operations of the new consolidated Pu storage facility at INEL are presented in Table 4.2.3.9–3. The impacts from all site operations, including the consolidated storage facility, are included in this table. Total site impacts, which include the No Action impact plus the consolidation alternative, are provided. All analyses to support the values presented in this table are provided in Section M.3.

The HI to the MEI of the public is 4.5×10^{-5} , and the cancer risk is 5.9×10^{-8} as a result of operation of the new consolidated Pu storage facility in the year 2030. The HI and cancer risk would remain constant over 50 years of operation, because exposures are expected remain the same. The total site operation, including the consolidated facility, would result in an HI of 1.5×10^{-2} and a cancer risk of 3.7×10^{-6} for the MEI in the year 2030. This would be expected to remain constant as a result of 50 years of operation.

The HI to the onsite worker would be 1.3×10^{-3} , and the cancer risk is 1.2×10^{-5} as a result of operation of the new consolidated Pu storage facility in the year 2030. The HI and cancer risk would remain constant over 50 years of operation, because exposures are expected to remain the same. The total site operation, including the consolidated Pu storage facility, would result in an HI of 0.22 and a cancer risk of 7.8×10^{-4} for the onsite worker in the year 2030. This would be expected to remain constant as a result of 50 years of operation.

Facility Accidents. A set of potential accidents have been postulated for consolidation of Pu for which there may be releases of Pu that may impact onsite workers and the offsite population. The accident

consequences and risks to a worker located 1,000 m (3,280 ft) from the accident release point, the maximum offsite individual located at the site boundary, and the population located within 80 km (50 mi) of the accident release point are summarized in Table 4.2.3.9–6. For the set of accidents analyzed, the maximum number of cancer fatalities in the population within 80 km (50 mi) would be 0.36 at INEL for the beyond design basis earthquake accident scenario with an estimated probability of 1.0×10^{-7} per year (for example, probability of severe earthquake occurring is estimated to be about 1.0×10^{-5} , once in 100,000 years, multiplied by a damage and release probability of 0.01). The corresponding 50-year facility lifetime risk from the same accident scenario for the population, maximum offsite individual, and worker at 1,000 m (3,280 ft), would be 1.8×10^{-6} , 8.4×10^{-10} , and 1.1×10^{-7} , respectively. The maximum population 50-year facility lifetime risk would be 1.2×10^{-3} (for example, one fatality in about 42,000 years) at INEL for the PCV penetration by corrosion accident scenario with a probability of 0.064 per year. The corresponding maximum offsite individual and worker 50-year facility lifetime risks would be 5.8×10^{-7} and 5.4×10^{-5} , respectively. Section M.5 presents additional facility accident data and summary descriptions of the accident scenarios identified in Table 4.2.3.9–6.

Involved workers, those that would work in the facilities associated with the proposed action, may be subject to injury and, in some cases, fatality as a result of potential accidents. The locations of workstations, number of workers, personnel protective features, engineered safety features, and other design details affect the extent of worker exposures to accidents. Certain accidents such as fires, explosions, and criticality could cause fatalities

Table 4.2.3.9–6. Consolidation Alternative Accident Impacts at Idaho National Engineering Laboratory

Accident Description	Worker at 1,000 m		Maximum Offsite Individual		Population to 80 km		Accident Frequency (per yr)
	Risk of Cancer Fatality (per 50 yr) ^a	Probability of Cancer Fatality ^b	Risk of Cancer Fatality (per 50 yr) ^a	Probability of Cancer Fatality ^b	Risk of Cancer Fatality (per 50 yr) ^a	Number of Cancer Fatalities ^c	
PCV puncture by forklift	1.2×10^{-7}	4.1×10^{-6}	1.3×10^{-9}	4.4×10^{-8}	2.9×10^{-6}	9.6×10^{-5}	6.0×10^{-4}
PCV breach by firearms discharge	7.2×10^{-9}	4.1×10^{-7}	7.8×10^{-11}	4.4×10^{-9}	1.7×10^{-7}	9.6×10^{-6}	3.5×10^{-4}
PCV penetration by corrosion	5.4×10^{-5}	1.7×10^{-5}	5.8×10^{-7}	1.8×10^{-7}	1.2×10^{-3}	3.9×10^{-4}	0.064
Vault fire	5.7×10^{-8}	0.011	4.7×10^{-10}	9.3×10^{-4}	1.0×10^{-6}	0.20	1.0×10^{-7}
Truck bay fire	2.9×10^{-9}	5.7×10^{-4}	3.1×10^{-11}	6.2×10^{-6}	6.7×10^{-8}	0.013	1.0×10^{-7}
Spontaneous combustion	2.9×10^{-11}	8.2×10^{-7}	3.1×10^{-13}	8.9×10^{-9}	6.7×10^{-10}	1.9×10^{-5}	7.0×10^{-7}
Explosion in the vault	6.7×10^{-9}	1.3×10^{-3}	7.3×10^{-11}	1.5×10^{-5}	1.6×10^{-7}	0.031	1.0×10^{-7}
Explosion outside of vault	3.1×10^{-11}	6.2×10^{-6}	3.3×10^{-13}	6.7×10^{-8}	7.2×10^{-10}	1.4×10^{-4}	1.0×10^{-7}
Nuclear criticality	2.0×10^{-11}	4.0×10^{-6}	1.9×10^{-13}	3.9×10^{-8}	4.5×10^{-11}	8.9×10^{-6}	1.0×10^{-7}
Beyond evaluation basis earthquake	1.1×10^{-7}	0.021	8.4×10^{-10}	1.7×10^{-4}	1.8×10^{-6}	0.36	1.0×10^{-7}
Expected risk ^d	5.4×10^{-5}	–	5.8×10^{-7}	–	1.3×10^{-3}	–	–

^a The risk values are calculated by multiplying the probability of cancer fatality (for the worker at 1,000 m or the maximum offsite individual) or the number of cancer fatalities (for the population to 80 km) by the accident frequency and the number of years of operation.

^b Increased likelihood (or probability) of cancer fatality to a hypothetical individual (a single onsite worker at a distance of 1,000 m or the site boundary, whichever is smaller or to a hypothetical individual in the offsite population located at the site boundary) if exposed to the indicated dose. The value assumes the accident has occurred.

^c Estimated number of cancer fatalities in the entire offsite population out to a distance of 80 km if exposed to the indicated dose. The value assumes the accident has occurred.

^d Expected risk is the sum of the risks over the 50-year lifetime of the facility.

Note: All values are mean values.

Source: Calculated using the source terms in Tables M.5.2.1.1–5 and M.5.2.1.1–6 and the MACCS computer code.

to workers close to the accident. Prior to construction of a new or modification of an existing facility, DOE Orders require detailed safety analyses to assure that facility designs and operating procedures limit the number of workers in hazardous areas and minimize risk of injury or fatality in the event of an accident.

Collocation Alternative

Construct New Plutonium and Highly Enriched Uranium Storage Facilities

This section includes a description of radiological and hazardous chemical releases and their associated impacts resulting from either normal operation or accidents involved with the consolidation of Pu storage and collocation with HEU storage facilities at INEL. This storage would take place in a new Pu and HEU storage facility. Normal operation of the new collocated storage facility at INEL would result in impacts that are within applicable regulatory limits.

[Text deleted.]

Normal Operation. There would be no radiological releases during the construction of a new collocated storage facility at INEL. Construction worker exposures to material potentially contaminated with radioactivity (for example, from construction activities involved with existing contaminated soil) would be limited to assure that doses are maintained ALARA. Toward this end, construction workers would be monitored, as appropriate. Limited hazardous chemical releases are anticipated as a result of construction activities. However, concentrations would be within the regulated exposure limits. During normal operation, there would be both radiological and hazardous chemical releases to the environment and also direct in-plant exposures. The resulting doses and potential health effects on the public and workers are described below.

Radiological Impacts. Radiological impacts on the public resulting from the normal operation of the new collocated storage facility at INEL are presented in Table 4.2.3.9–1. The impacts from all site operations, including the new storage facility, are also given in the table. To put operational doses into perspective, comparisons with doses from natural background radiation are included in the table.

The dose to the MEI from annual storage facility operation would be 1.6×10^{-6} mrem. From 50 years of operation, the corresponding risk of fatal cancer to this individual would be 4.0×10^{-11} . The impacts on the average individual would be less. As a result of storage facility operation in the year 2030, the population dose would be 1.8×10^{-5} person-rem. The corresponding number of fatal cancers in this population from 50 years of operation would be 4.5×10^{-7} .

The dose to the MEI from annual total site operations is within the radiological limits specified in NESHAPS (40 CFR 61, Subpart H) and DOE Order 5400.5, and would be 0.018 mrem. From 50 years of operation, the corresponding risks of fatal cancer to this individual would be 4.4×10^{-7} . The impacts on the average individual would be less. This activity would be included in a program to ensure that doses to the public are ALARA. As a result of total site operation in the year 2030, the population dose would be within the limit in proposed 10 CFR 834 and would be 2.4 person-rem. The corresponding number of fatal cancers in this population from 50 years of operation would be 0.061.

Doses to onsite workers from normal operations are given in Table 4.2.3.9–2. Included are involved workers directly associated with the new storage facility, workers who are not involved with the new storage facility, and the entire workforce at INEL. All doses fall within regulatory limits and administrative control levels. The associated risks and numbers of fatal cancers among the different workers from 50 years of operation are included in the table. Dose to individual workers would be kept low by instituting badged monitoring and ALARA programs and also workers rotations. As a result of the implementation of these mitigation measures, the actual number of fatal cancers calculated would be lower for the operation of this facility.

Hazardous Chemical Impacts. Hazardous chemical impacts on the public and on the onsite worker resulting from the normal operations of the new consolidated Pu storage facility and collocation with HEU storage facilities at INEL are presented in Table 4.2.3.9–3. The impacts from all site operations, including the consolidation of Pu and collocation with HEU storage facilities are also included in this table. Total site impacts, which include the No Action impact plus the facility, are provided. All analyses to support the values presented in this table are provided in Section M.3.

The HI to the MEI of the public is 7.7×10^{-5} , and the cancer risk is 5.9×10^{-8} as a result of operation of the new consolidation of Pu and collocation with HEU storage facilities in the year 2030. The HI and cancer risk would remain constant over 50 years of operation, because exposures are expected to remain the same. The total site operation, including the new facility, would result in an HI of 1.5×10^{-2} and a cancer risk of 3.7×10^{-6} for the onsite worker in the year 2030. This would be expected to remain constant as a result of 50 years of operation.

The HI to the onsite worker would be 1.9×10^{-3} , and the cancer risk is 1.2×10^{-5} as a result of operation of the new consolidation of Pu and collocation with HEU storage facilities in the year 2030. The HI and cancer risk would remain constant over 50 years of operation, because exposures are expected to remain the same. The total site operation, including the new facility would result in an HI of 0.22 and an cancer risk of 7.8×10^{-4} for the onsite worker in the year 2030. This would be expected to remain constant as a result of 50 years of operation.

Facility Accidents. A set of potential accidents have been postulated for collocation of Pu and HEU for which there may be releases of Pu or HEU that may impact onsite workers and the offsite population. The consequences and risks of potential accidents that release both Pu and HEU would be bounded by the impacts associated with Pu. The accident consequences and risks to a worker located 1,000 m (3,280 ft) from the accident release point, the maximum offsite individual located at the site boundary, and the general population located within 80 km (50 mi) of the accident release point are summarized in Table 4.2.3.9–7. For the set of accidents analyzed, the maximum number of cancer fatalities in the population within 80 km (50 mi) would be 0.36 at INEL for the beyond design basis earthquake accident scenario with an estimated probability of 1.0×10^{-7} per year (for example, probability of severe earthquake occurring is estimated to be about 1.0×10^{-5} , once in 100,000 years, multiplied by a damage and release probability of 0.01). The corresponding 50-year facility lifetime risk from the same accident scenario for the population, maximum offsite individual, and worker at 1,000 m (3,280 ft), would be 1.8×10^{-6} , 8.4×10^{-10} , and 1.1×10^{-7} , respectively. The maximum population 50-year facility lifetime risk would be 1.2×10^{-3} (for example, one fatality in about 42,000 years) at INEL for the PCV penetration by corrosion accident scenario with a probability of 0.064 per year. The corresponding maximum offsite individual and worker 50-year facility lifetime risks would be 5.8×10^{-7} and 5.4×10^{-5} , respectively. Section M.5 presents additional facility accident data and summary descriptions of the accident scenarios identified in Table 4.2.3.9–7.

Involved workers, those that would work in the facilities associated with the proposed action, may be subject to injury and, in some cases, fatality as a result of potential accidents. The locations of workstations, number of workers, personnel protective features, engineered safety features, and other design details affect the extent of worker exposures to accidents. Certain accidents such as fires, explosions and criticality could cause fatalities to workers close to the accident. Prior to construction of a new or modification of an existing facility, DOE Orders require detailed safety analyses to assure that facility designs and operating procedures limit the number of workers in hazardous areas and minimize risk of injury or fatality in the event of an accident.

Subalternative Not Including Strategic Reserve and Weapons Research and Development Material

If the strategic reserve and weapons R&D is not included, the impacts on the public and on workers from the accident-free storage activities would be reduced in proportion to the decrease in the amount of material stored. The impacts from total site operations would decrease slightly. This subalternative applies to the Upgrade With

Table 4.2.3.9–7. Collocation Alternative Accident Impacts at Idaho National Engineering Laboratory

Accident Description	Worker at 1,000 m		Maximum Offsite Individual		Population to 80 km		
	Risk of Cancer Fatality (per 50 yr) ^a	Probability of Cancer Fatality ^b	Risk of Cancer Fatality (per 50 yr) ^a	Probability of Cancer Fatality ^b	Risk of Cancer Fatality (per 50 yr) ^a	Number of Cancer Fatalities ^c	Accident Frequency (per yr)
PCV puncture by forklift	1.2x10 ⁻⁷	4.1x10 ⁻⁶	1.3x10 ⁻⁹	4.4x10 ⁻⁸	2.9x10 ⁻⁶	9.6x10 ⁻⁵	6.0x10 ⁻⁴
PCV breach by firearms discharge	7.2x10 ⁻⁸	4.1x10 ⁻⁷	7.8x10 ⁻¹¹	4.4x10 ⁻⁹	1.7x10 ⁻⁷	9.6x10 ⁻⁶	3.5x10 ⁻⁴
PCV penetration by corrosion	5.4x10 ⁻⁵	1.7x10 ⁻⁵	5.8x10 ⁻⁷	1.8x10 ⁻⁷	1.2x10 ⁻³	3.9x10 ⁻⁴	0.064
Vault fire	5.7x10 ⁻⁸	0.011	4.7x10 ⁻¹⁰	9.3x10 ⁻⁴	1.6x10 ⁻⁶	0.26	1.0x10 ⁻⁷
Truck bay fire	2.9x10 ⁻⁹	5.7x10 ⁻⁴	3.1x10 ⁻¹¹	6.2x10 ⁻⁶	6.7x10 ⁻⁸	0.013	1.0x10 ⁻⁷
Spontaneous combustion	2.9x10 ⁻¹¹	8.2x10 ⁻⁷	3.1x10 ⁻¹³	8.9x10 ⁻⁸	6.7x10 ⁻¹⁰	1.9x10 ⁻⁵	7.0x10 ⁻⁷
Explosion in the vault	6.7x10 ⁻⁹	1.3x10 ⁻³	7.3x10 ⁻¹⁰	1.5x10 ⁻⁵	1.6x10 ⁻⁷	0.031	1.0x10 ⁻⁷
Explosion outside of vault	3.1x10 ⁻¹¹	6.2x10 ⁻⁶	3.3x10 ⁻¹³	6.7x10 ⁻⁸	7.2x10 ⁻¹⁰	1.4x10 ⁻⁴	1.0x10 ⁻⁷
Nuclear criticality	2.0x10 ⁻¹¹	4.0x10 ⁻⁶	1.9x10 ⁻¹³	3.9x10 ⁻⁸	4.5x10 ⁻¹¹	8.9x10 ⁻⁶	1.0x10 ⁻⁷
Beyond evaluation basis earthquake	1.1x10 ⁻⁷	0.021	8.4x10 ⁻¹⁰	1.7x10 ⁻⁴	1.8x10 ⁻⁶	0.36	1.0x10 ⁻⁷
Expected risk ^d	7.5x10 ⁻⁵	–	5.8x10 ⁻⁷	–	1.3x10 ⁻³	–	–

^a The risk values are calculated by multiplying the probability of cancer fatality (for the worker at 1,000 m or the maximum offsite individual) or the number of cancer fatalities (for the population to 80 km) by the accident frequency and the number of years of operation.

^b Increased likelihood (or probability) of cancer fatality to a hypothetical individual (a single onsite worker at a distance of 1,000 m or the site boundary, whichever is smaller or to a hypothetical individual in the offsite population located at the site boundary) if exposed to the indicated dose. The value assumes the accident has occurred.

^c Estimated number of cancer fatalities in the entire offsite population out to a distance of 80 km if exposed to the indicated dose. The value assumes the accident has occurred.

^d Expected risk is the sum of the risks over the 50-year lifetime of the facility.

Note: All values are mean values.

Source: Calculated using the source terms in Tables M.5.2.1.1–5 and M.5.2.1.1–6 and the MACCS computer code.

All or Some RFETS and LANL Pu Subalternative, the Consolidation Alternative, and the Collocation Alternative. The risks due to accidents would also tend to be lower.

Phaseout

Normal Operation. A phaseout of existing Pu storage facilities at INEL would reduce the impacts from radiological and chemical releases and exposures to levels slightly below the No Action levels. All workers involved in the removal of the Pu from INEL would be monitored to assure that their doses remain within regulatory limits and as low as reasonably achievable.

Facility Accidents. The phaseout operation will be conducted in accordance with DOE Orders to ensure that the risk to the public of prompt fatalities due to accidents or of cancer fatalities due to operations will be minimized. For current operations in the facility that would be phased out, the safety of workers and the public from accidents is controlled by Technical Safety Requirements that are specified in SARs or Basis for Interim Operations documents that have been prepared for the facility. Prior to initiating phaseout, the potential for accidents that could impact workers and the public will be assessed and, if necessary, applicable existing safety documentation will be modified to ensure safety for workers and the public.

4.2.3.10 Waste Management

This section summarizes the impacts on waste management at INEL under No Action and for each of the long-term storage alternatives to include the phaseout of Pu storage. There is no spent nuclear fuel or HLW associated with Pu or HEU storage. Table 4.2.3.10-1 lists the projected sitewide waste generation rates and treatment, storage, and disposal capacities under No Action for 2005. Projections for No Action were derived from the most recent available environmental data, with appropriate adjustments made for those changing operational requirements where the volume of wastes generated is identifiable. The projection does not include wastes from future, yet uncharacterized, environmental restoration activities. The projections for No Action could change significantly depending on the decisions resulting from the PEIS on waste management being prepared by the Department. Table 4.2.3.10-2 provides the estimated incremental operational waste volumes projected to be generated at INEL as a result of the various storage alternatives prior to treatment. Some of the waste values described in this section are different than the waste values in the table. For those values that differ (for example, LLW), the table gives waste generated pre-treatment values and the text discusses post-treatment values (indicated as after treatment and volume reduction). The waste volumes generated from the various storage alternatives and the resultant waste effluent used for the waste impact analysis are shown in Section E.3.1. Facilities that would support the storage of Pu and HEU would treat and package all waste generated into forms that would enable staging and/or disposal in accordance with RCRA and other applicable statutes. Depending in part on decisions in waste-type-specific RODs for the Waste Management PEIS, wastes could be treated and disposed of onsite or at regionalized or centralized DOE sites. For the purposes of analyses only, this PEIS assumes that TRU and mixed TRU waste would be treated onsite to the current planning-basis WIPP WAC, and shipped to WIPP for disposal. This PEIS also assumes that LLW, mixed LLW, hazardous, and nonhazardous wastes would be treated and disposed of in accordance with current site practice.

Preferred Alternative: No Action Alternative

Under this alternative, INEL would receive spent nuclear fuel from numerous offsite generators/storage locations, and high-level, TRU, low-level, mixed, hazardous, and nonhazardous wastes would continue to be managed from the missions outlined in Section 3.4. INEL's focus would be to continue the restoration of priority sites and the stabilization of other sites. By the year 2010, much of the existing wastes at INEL would have been treated and disposed of or stored in compliance with existing regulations. The waste treatment activities that are planned to be still in operation are the calcination of liquid HLW and LLW after completion of the processing of special fuels and residuals at the ICPP, the retrieval and repackaging of buried TRU waste, and stabilization of spent nuclear fuel for long-term storage. Under No Action, INEL would continue to store its inventory of Pu and to treat, store, and dispose of its legacy and newly generated wastes in current and planned facilities.

Spent nuclear fuel would be managed in accordance with the ROD published on June 1, 1995 (60 FR 28680) from the *Department of Energy Programmatic Spent Nuclear Fuel Management and Idaho National Engineering Laboratory Environmental Restoration and Waste Management Programs Final Environmental Impact Statement* (DOE/EIS-0203-F) as amended on March 8, 1996 (61 FR 9441). According to the ROD, INEL would ship its existing inventory of aluminum-clad spent nuclear fuel to SRS. In addition, INEL would receive non-aluminum-clad spent nuclear fuel from the Navy, Hanford, SRS, West Valley Demonstration Project, foreign research reactors, universities, and other generators or storage sites. The following INEL spent nuclear fuel projects will be implemented as a result of the ROD: Increased Rack Capacity for Building 666, Dry Fuel Storage Facility, and Expended Core Facility Dry Cell Project. Decisions regarding other ongoing or planned projects, as it was with the Electrometallurgical Process Demonstration (61 FR 25647), would be made in the future pending further project definition, funding priorities, and appropriate review under NEPA. TRU waste already packaged to current planning-basis WIPP WAC would either be stored or would have been shipped. Mixed waste would have been treated and disposed of according to the INEL Site Treatment Plan, which was developed to comply with the *Federal Facility Compliance Act*. Solid LLW would continue to be buried at the onsite RWMC. Under No Action, the processing of legacy wastes would require new facilities since the necessary treatment, storage, and disposal facilities either do not exist or are nearing capacity.

The Pu addressed in this PEIS is limited to materials currently stored within protected vaults and gloveboxes, and additional materials within process lines and process equipment associated with Pu storage and surveillance facilities. The Pu facilities have been used to conduct Pu processing operations such as Pu purification, Pu recovery, oxide production, metal production, and parts fabrication. The Pu facilities have also been used for receipt and large-scale storage of onsite and offsite Pu, uranium scrap, and product materials. Under No Action, INEL would not be able to maintain the inventory of Pu scrap and metal in a state that provides for long-term storage while awaiting a decision for future disposition. Modifications to the facilities would be required to meet current regulations. Maintenance, assay, packaging, and monitoring of the inventory would produce TRU, low-level, hazardous, and nonhazardous wastes. These wastes would be treated, stored, and disposed of in compliance with existing regulations.

Upgrade Alternative

Upgrade Without Rocky Flats Environmental Technology Site or Los Alamos National Laboratory Plutonium Subalternative

Modify Existing and Construct New Argonne National Laboratory–West Facilities for Continued Plutonium Storage

The upgrading of the existing ANL-W storage facility for the continued storage of Pu would have a small impact on existing ANL-W and INEL waste management activities. Construction waste volumes as presented in Table E.3.1.1–2 would have minimal impact on ANL-W and INEL waste management activities. Waste generated during construction would consist of wastewater and solid nonhazardous and hazardous wastes. Nonhazardous waste would be disposed of as part of the construction project by the contractor, and the hazardous waste would be shipped offsite to commercial RCRA-permitted treatment and disposal facilities. Operational waste volumes as shown in Table 4.2.3.10–2 would increase slightly due to increased surveillance activities over No Action.

Following treatment and volume reduction of TRU waste, approximately 1 m^3 (1.3 yd^3) of solid TRU waste and 1 m^3 (1.3 yd^3) of solid mixed TRU waste from damaged PCVs and contaminated glovebox panels, windows, and gaskets would need to be treated and packaged to meet the current planning-basis WIPP WAC or alternative treatment level. While awaiting shipment to WIPP (depending on decisions made in the ROD associated with the supplemental EIS for the proposed continued phased development of WIPP for disposal of TRU waste), the TRU waste would be stored in above-grade storage facilities in the INEL RWMC and processed in the planned Advanced Mixed Waste Treatment Project. One additional truck shipment every 4 years or, if applicable, one regular train shipment every 9 years or one dedicated train shipment every 25 years would be required to transport this waste to WIPP.

After treatment and volume reduction, approximately 250 m^3 (327 yd^3) of LLW from solidified liquid LLW (such as decontamination solutions), protective clothing, HEPA filters, glovebox gloves, and decontamination equipment and materials would be packaged at the existing Waste Experimental Reduction Facility and would require disposal in the RWMC. Assuming a land usage of $6,200 \text{ m}^3/\text{ha}$ ($3,300 \text{ yd}^3/\text{acre}$), this would require 0.04 ha/year (0.1 acre/yr) of LLW disposal area.

Contaminated shielding and cleaning materials would be the major contributors to the 0.015 m^3 (4 gal) of liquid and 27 m^3 (35 yd^3) of solid mixed LLW. This small amount of mixed LLW could be treated and disposed of in accordance with the INEL Site Treatment Plan through the use of existing and planned facilities.

The 0.15 m^3 (40 gal) of liquid hazardous wastes such as lubricants, cleaning solvents, paint, and lube oil and 1 m^3 (1.3 yd^3) of solid hazardous wastes such as lead packing, wipes, and solid materials contaminated with oils, lubricants, and cleaning solvents would have a minimal impact on waste management activities at INEL. While awaiting shipment to an offsite RCRA-permitted treatment and disposal facility, the INEL Hazardous Waste Storage Facility has adequate capacity to handle this increase.

Approximately 7,600 m³ (2,010,000 gal) of liquid nonhazardous wastes to include sanitary, utility, and process wastewaters, and cooling system blowdown could be handled by the existing Industrial Waste Pond and ANL-W sewage lagoons. After volume reductions, 120 m³ (157 yd³) of solid nonhazardous wastes such as clean non-Pu metals, packing materials, office trash, defective and damaged equipment, and industrial waste from utility and maintenance operations would be sent to the existing sanitary/industrial landfill on the INEL site.

Upgrade With All or Some Rocky Flats Environmental Technology Site and Los Alamos National Laboratory Plutonium Subalternative

Modify Existing and Construct New Argonne National Laboratory–West Facilities for Continued Plutonium Storage

Construction and operation of an upgraded Pu storage facility that would accommodate material from RFETS and LANL would have the same waste management impacts as the same Upgrade Without RFETS or LANL material for all but nonhazardous wastes. The generation of TRU, mixed TRU, and LLW would be the same during operations. While the liquid mixed low-level and hazardous waste generated during operations is slightly higher, it is not significantly different. Therefore, the impacts would be similar.

Approximately 10,300 m³ (2,720,000 gal) of liquid nonhazardous wastes to include sanitary, utility, and process wastewaters and cooling system blowdown can be handled by the existing Industrial Waste Pond and ANL-W sewage lagoons. After volume reduction, 173 m³ (226 yd³) of solid nonhazardous wastes such as clean non-Pu metals, packing materials, office trash, defective and damaged equipment, and industrial waste from utility and maintenance operations would be sent to the existing sanitary/industrial landfill on the INEL site.

Distributing the RFETS and LANL Pu to more than one site would reduce the operational waste volumes. The decrease would be proportional to the amount of material.

Consolidation Alternative

Construct New Plutonium Storage Facility

Construction and operation of a consolidated Pu storage facility would have an impact on existing ANL-W waste management activities by increasing the generation of TRU, low-level, mixed, hazardous, and nonhazardous wastes. Waste generated during construction would consist of wastewater, nonhazardous solids, and hazardous wastes. The nonhazardous wastes would be disposed of as part of the construction project by the contractor, and the hazardous wastes would be shipped to commercial RCRA-permitted treatment and disposal facilities. No soil contaminated with hazardous material or radioactive constituents is expected to be generated during construction. However, if any was generated it would be managed in accordance with site practice and all applicable Federal and State regulations. The types of operational wastes from the consolidated Pu storage facility would be same as those from the upgraded facility, but the quantity would change, as shown in Table 4.2.3.10–2.

After treatment and volume reduction of TRU waste, approximately 5 m³ (7 yd³) of solid TRU waste and 4 m³ (5 yd³) of mixed TRU waste from leaded gloves, windows, and contaminated Pb shielding would be treated and packaged to meet the current planning-basis WIPP WAC or alternative treatment level. While awaiting shipment to WIPP (depending on decisions resulting from the supplemental EIS noted earlier), the TRU and mixed TRU waste could be stored in above-grade storage facilities in the INEL RWMC and processed in the planned Idaho Waste Processing Facility. One additional truck shipment per year or, if applicable, one regular train shipment every 2 years, or one dedicated train shipment every 6 years, would be required to transport these wastes to WIPP.

Following treatment and volume reduction, approximately 630 m³ (824 yd³) of LLW would require disposal in the RWMC. This would require approximately 0.1 ha/year (0.3 acre/yr) of LLW disposal area at the RWMC. The 0.2 m³ (50 gal) of liquid mixed LLW and 65 m³ (85 yd³) of solid mixed LLW would be treated and disposed of in accordance with the INEL Site Treatment Plan through the use of existing and planned facilities. The 2 m³ (476 gal) of liquid hazardous waste and 2 m³ (3 yd³) of solid hazardous wastes would have minimal impact on waste management activities at INEL, as there is adequate storage capacity as noted earlier in the upgrade alternative.

The treatment of 65,900 m³ (17,400,000 gal) of liquid nonhazardous wastes could use existing sanitary wastewater treatment systems, but the construction of utility and process wastewater treatment systems would be required. After volume reduction, 660 m³ (863 yd³) of solid nonhazardous wastes would require disposal at the existing sanitary/industrial landfill on the INEL site.

Collocation Alternative

Construct New Plutonium and Highly Enriched Uranium Storage Facilities

Construction and operation of a consolidated Pu storage facility collocated with HEU storage would have an impact on existing INEL waste management activities, increasing the generation of TRU, low-level, mixed, hazardous, and nonhazardous wastes. Waste generated during construction would consist of wastewater, nonhazardous solids, and hazardous wastes. The nonhazardous wastes would be disposed of as part of the construction project by the contractor, and the hazardous wastes would be shipped to a commercial RCRA-permitted treatment and disposal facility. No soil contaminated with hazardous material or radioactive constituents is expected to be generated during construction. However, if any was generated it would be managed in accordance with site practice and all applicable Federal and State regulations. Because there is no TRU or mixed TRU waste associated with HEU storage, the impacts from TRU and mixed TRU wastes are identical to those identified in the Consolidated Pu Storage Alternative. The sources of waste are similar to those of the upgraded Pu storage facility, except the source of radioactive contamination from the HEU storage is uranium. Operational waste volumes are shown in Table 4.2.3.10–2.

Following treatment and volume reduction, approximately 630 m³ (824 yd³) of solid LLW contaminated with Pu and 20 m³ (26 yd³) contaminated with uranium would require disposal in the RWMC. This would require approximately 0.1 ha/yr (0.3 acre/yr) of LLW disposal area. The 0.2 m³ (55 gal) of liquid mixed LLW and 66 m³ (86 yd³) of solid mixed LLW would be treated and disposed of in accordance with the INEL Site Treatment Plan through the use of existing and planned facilities. The 2 m³ (528 gal) of liquid hazardous wastes and 2 m³ (3 yd³) of solid hazardous wastes would have a minimal impact on waste management activities at INEL, as there is adequate storage capacity as noted earlier in the upgrade alternative.

The treatment of 86,800 m³ (22,900,000 gal) of liquid nonhazardous wastes could use existing sanitary wastewater treatment systems, but the construction of utility and process wastewater treatment systems would be required. After volume reduction, 860 m³ (1,120 yd³) of solid nonhazardous wastes would require disposal at the existing sanitary/industrial landfill on the INEL site.

Subalternative Not Including Strategic Reserve and Weapons Research and Development Materials

The exclusion of strategic reserve and weapons R&D materials would reduce the amount of operational waste volumes shown in Table 4.2.3.10–2 for the Upgrade with All or Some RFETS and LANL Pu Subalternative, the Consolidation Alternative, and the Collocation Alternative. The decrease would be proportional to the amount of material excluded.

Phaseout

The phaseout of Pu storage would have no impact on INEL waste management activities. The quantities of waste would not decrease until D&D in which Pu is stored was completed.

4.2.4 PANTEX PLANT

A listing of the proposed long-term storage alternatives, subalternatives, and related actions, including the No Action Alternative, at Pantex is provided below. The potential impacts of implementing these alternatives and related actions at Pantex are described in the following sections: land resources, site infrastructure, air quality and noise, water resources, geology and soils, biological resources, cultural and paleontological resources, socioeconomics, public and occupational health and safety, and waste management. The specific long-term storage alternatives proposed for Pantex are the Preferred Alternative, the Upgrade Alternative, the Consolidation Alternative, and the Collocation Alternative.

Preferred Alternative

Upgrade With RFETS Pu Pits Subalternative:

Modify existing buildings in Zone 12 South to accommodate Pantex Pu pits and RFETS Pu pits.

The Preferred Alternative for Pantex is to store those surplus pits currently stored at Pantex, and pits from RFETS at Pantex pending disposition. This alternative includes storing strategic reserve pits at Pantex in accordance with the Preferred Alternative for the Stockpile Stewardship and Management PEIS. The Preferred Alternative would modify the existing buildings 12-66 and 12-82 and utilize buildings 12-116 and 12-117 in Zone 12 South. Pits from RFETS would be moved beginning in 1997. RFETS pits would be transported to Pantex as described in Section 4.4, repackaged in AL-R8 containers (if AT-400A containers are unavailable), and placed in storage in Zone 4 West. The storage of the RFETS pits would be similar to pits currently in storage from disassembly operations at Pantex. Placing the RFETS pits in Zone 4 would not exceed the 20,000 pits storage analyzed in the Pantex EIS.

The Preferred Alternative for storage identified in this PEIS calls for the transfer of Pu pits from RFETS to Pantex with storage of surplus pits continuing until disposition. Pits to be transferred would be packaged in FL (Type B) containers at RFETS before shipment and, upon receipt at Pantex, would be repackaged into AL-R8 containers in Zone 12 South and placed into storage in Zone 4 West pending availability of AT-400A containers and relocation to upgraded storage facilities in Zone 12 South. The environmental analysis of intersite transportation for shipment of the RFETS Pu to Pantex is given in Section 4.4 of this PEIS for both workers and the public. Storage of Pantex pits at Zone 4 West is analyzed in the Pantex EIS; transportation from Zone 4 to Zone 12 and repackaging of the pits from AL-R8 to AT-400A containers, storage, and intrasite transportation of RFETS pits at Zone 4 West are described in Appendix Q.

The data for the Upgrade With RFETS Pu and LANL Pu Subalternative was based on a storage vault with a capacity of 40,000 positions. The data for the Upgrade Without RFETS Pu or LANL Pu Subalternative was based on a storage vault with a capacity of approximately 25,000 positions including about 20,000 positions for surplus pits and about 5,000 positions for the strategic reserve. Because the Preferred Alternative would remove only the pits from RFETS for storage at Pantex, and not all the RFETS Pu and LANL Pu, the storage of 20,000 pits analyzed in the Pantex EIS would not be exceeded.

Proposed Storage Activities at Pantex Plant

- **No Action Alternative:** Continue to store Pantex Pu material within the scope of this PEIS (which consists entirely of pits) in Zone 4 Magazines in stabilized form pursuant to DNFSB Recommendation 94-1.
- **Upgrade Alternative:** There are three subalternatives under this storage alternative.
 - ***Upgrade With RFETS Pu Pits Subalternative (Preferred Alternative):*** Modify existing buildings in Zone 12 South to accommodate Pantex Pu pits and RFETS Pu pits.
 - ***Upgrade Without RFETS Pu or LANL Pu Subalternative:*** Modify existing buildings in Zone 12 South to accommodate Pantex Pu material.
 - ***Upgrade With All or Some RFETS Pu and LANL Pu Subalternative:*** Modify existing buildings in Zone 12 South to accommodate Pantex, RFETS, and LANL Pu material.
- **Consolidation Alternative:** Two options to accommodate all Pu material within the scope of this PEIS: Construct a new facility and modify existing buildings in Zone 12 South; or construct a larger new facility in Zone 12 South.
- **Collocation Alternative:** Construct a new facility in Zone 12 South to accommodate all Pu and HEU material within the scope of this PEIS.
- **Subalternative Not Including Strategic Reserve and Weapons Research and Development Materials:** Facility and other resource requirements would be smaller than the No Action Alternative, the Upgrade Alternative, the Consolidation Alternative, and the Collocation Alternative.
- **Phaseout:** Pantex Pu material within the scope of this PEIS would be moved out of Zone 4 to the Consolidation or Collocation site (located at another DOE site) or to disposition (for surplus Pu).

4.2.4.1 Land Resources

No Action Alternative

Under this alternative, Pantex Pu material (which consists entirely of pits) would continue to be stored at the current storage location in Zone 4 Magazines pursuant to DNFSB Recommendation 94–1. The ongoing (no new action) activities conform with present and future land-use plans, policies, and controls. A description of No Action facilities and processes is presented in Section 2.2.4. Therefore, no effects to land resources would be anticipated at Pantex beyond those of existing and future activities that are independent of the proposed action.

Upgrade Alternative

Preferred Alternative: Upgrade With Rocky Flats Environmental Technology Site Plutonium Pits Subalternative

Modify Existing Zone 12 South Facilities for Continued Plutonium Storage

The Pu storage upgrade at Pantex consists of existing facilities and the expansion of one facility and associated ramp within Zone 12 South to accommodate Pantex Pu and RFETS pit material. Land area requirements would be 0.18 ha (0.45 acres) during construction of which 0.1 ha (0.25 acres) would be used during operations. However, the facility would be situated on previously disturbed land. Buffer zone distances would be based on technical, safety, and security considerations.

Land Use. Construction and operation of the proposed upgrade would conform with the current *Pantex Site Development Plan*, which includes as part of its master plan the Fissile Materials Storage Facility in Zone 12 (PX DOE 1995g:8,11). The proposal would not change existing land use. As discussed in Section 4.2.4.8, immigration of workers would be anticipated only for operations. However, since projected housing vacancies would be sufficient to accommodate the slight population growth, no indirect effects to offsite lands would be expected.

The storage upgrade would not affect other site land uses. As discussed in Section 3.5.1, there would be no onsite effects to prime farmland. The upgrade would not be in conflict with the city of Amarillo's land-use plans, policies, and controls since they do not address Pantex.

Visual Resources. The proposed visual environment would be compatible with the existing industrialized landscape character. The current VRM Class 5 designation of Zone 12 would remain.

Upgrade Without Rocky Flats Environmental Technology Site Plutonium or Los Alamos National Laboratory Plutonium Subalternative

Modify Existing Zone 12 South Facilities for Continued Plutonium Storage

The Upgrade Without RFETS Pu or LANL Pu Subalternative is similar to the Upgrade With RFETS Pu Pits Subalternative because the modified facilities in Zone 12 South would be designed with adequate capacity to store all of the RFETS Pu pits. No additional resources would be required and therefore the impacts would be the same.

Upgrade With All or Some Rocky Flats Environmental Technology Site Plutonium and Los Alamos National Laboratory Plutonium Subalternative

Modify Existing Zone 12 South Facilities for Continued Plutonium Storage

Land area requirements during construction and operation for the proposed Pu storage facility at Pantex with all or some RFETS Pu and LANL Pu would be equal to that for Upgrade With RFETS Pu Pits Subalternative because the upgrade without would accommodate both subalternatives. Direct and indirect effects on land resources during construction and operation would be equal to that for Upgrade With RFETS Pu Pits Subalternative. [Text deleted.]

Consolidation Alternative

Construct New and Modify Existing Zone 12 South Facilities

This option would include the modification of existing buildings and construction of a new facility in Zone 12 South. Land area requirements would be 60.5 ha (149 acres) during construction of which 58 ha (143 acres) would be used during operations. However, the construction laydown area and storage facility would be situated on previously disturbed land and would not create any newly disturbed area. A buffer zone would be provided between facilities and the Pantex boundary.

Land Use. Construction and operation of this storage upgrade would be consistent with the site master plan as included within the current *Pantex Site Development Plan*, which identifies a Fissile Materials Storage Facility in Zone 12 (PX DOE 1995g:8,11). [Text deleted.] As discussed in Section 4.2.4.8, vacancies in the projected housing stock would be sufficient to accommodate the slight population growth due to the in-migration of construction and operational workers. Therefore, no indirect effects to offsite land use would be anticipated.

Construction and operation of this storage upgrade option would not affect other site land uses. There would be no onsite effects to prime farmland. This upgrade option would not be in conflict with the city of Amarillo's land-use plans, policies, and controls since they do not address Pantex.

Visual Resources. [Text deleted.] The proposed activities would be compatible with the existing industrialized landscape character. The current VRM Class 5 designation of Zone 12 would not change.

Construct New Plutonium Storage Facility

All the Pu would be stored at a new storage facility to be constructed in the north portion of Zone 12 South at Pantex. Land area requirements would be 58.5 ha (144 acres) during construction of which 56 ha (138 acres) would be used during operations. However, the construction laydown area and stand-alone storage facility would be entirely situated on previously disturbed land and would not create any newly disturbed area. A buffer zone would be provided between operations and the Pantex site boundary. Pu storage in existing DOE storage facilities would be phased out.

Land Use. The proposal would conform with the current *Pantex Site Development Plan*, which includes the Fissile Materials Storage Facility in Zone 12 (PX DOE 1995g:8,11) as part of its master plan. [Text deleted.] As discussed in Section 4.2.4.8, available projected housing vacancies would accommodate the population growth attributed to the in-migration of construction and operational workers. Therefore, no indirect effects to offsite land use would be anticipated.

Construction and operation would not affect other site land uses or prime farmland. This upgrade option would be consistent with the city of Amarillo's land-use plans, policies, and controls.

Visual Resources. [Text deleted.] The proposed visual environment would be compatible with the existing industrialized landscape character. The current VRM Class 5 designation of Zone 12 would remain.

Collocation Alternative

Construct New Plutonium and Highly Enriched Uranium Storage Facilities

The collocation alternative would store Pu and HEU within the scope of this PEIS at a new facility to be constructed in Zone 12 South at Pantex. Pu and HEU storage in existing DOE facilities would be phased out. Land area requirements would be 89.5 ha (221 acres) during construction of which 87 ha (215 acres) would be used during operations. However, the construction laydown area and storage facility would be situated on previously disturbed land and would not create any newly disturbed area. A buffer zone would be provided between facilities and the Pantex site boundary.

Land Use. Construction and operation would conform with the current *Pantex Site Development Plan*, which includes the Fissile Materials Storage Facility in Zone 12 (PX DOE 1995g:8,11) as part of its master plan. [Text deleted.] As discussed in Section 4.2.4.8, projected housing vacancies would be sufficient to accommodate the increase in demand for housing units due to the in-migration of construction and operational workers. Therefore, no indirect effects to offsite land use would be anticipated.

Construction and operation would not affect other site land uses or prime farmland. This Collocation Alternative would be consistent with the city of Amarillo's land-use plans, policies, and controls.

Visual Resources. Potential impacts from construction and operation to visual resources would be similar to those of the Consolidation Alternative.

Subalternative Not Including Strategic Reserve and Weapons Research and Development Materials

Under this subalternative, land effects during construction and operation would be almost the same in extent and magnitude to the No Action Alternative, Upgrade Alternative, Consolidation Alternative, and Collocation Alternative because the facility would be almost the same. However, because the smaller quantity of material would require smaller facilities, it is likely that less land area would be disturbed during construction and used during operations. [Text deleted.]

Phaseout

No new construction or upgrade of existing facilities would occur under phaseout of the Pu storage mission. Pantex Pu material would be moved out of Pantex to the consolidation or collocation site or disposition. Potential impacts to visual resources could occur if facilities are not maintained.

[Text deleted.]

4.2.4.2 Site Infrastructure

Pantex would be capable of supporting any of the storage alternatives without major modifications to the existing infrastructure. A comparison of site infrastructure and facilities resource needs for the storage alternatives is shown in Table 4.2.4.2–1. Neither the addition of all or part of the material currently stored at RFETS and LANL nor the removal of strategic reserve and weapons R&D material would require major site infrastructure changes at Pantex.

No Action Alternative

Because of the downsized production mission after nuclear weapons stockpile dismantlement actions are complete, a considerable reduction in site infrastructure requirements is expected to occur. As a result, Pantex can accommodate the No Action Alternative using the site infrastructure that is currently in place at the site.

Upgrade Alternative

Preferred Alternative: Upgrade With Rocky Flats Environmental Technology Site Plutonium Pits Subalternative

Modify Existing Zone 12 South Facilities for Continued Plutonium Storage

Construction to upgrade the existing storage facility to accommodate long-term storage of Pu currently at Pantex and RFETS pits would not affect the site infrastructure. Data for construction are presented in Appendix C. As shown in Table 4.2.4.2–1, operating the upgraded facility would not significantly affect the site infrastructure. All infrastructure requirements are within site capacities.

Upgrade Without Rocky Flats Environmental Technology Site Plutonium or Los Alamos National Laboratory Plutonium Subalternative

Modify Existing Zone 12 South Facilities for Continued Plutonium Storage

The Upgrade Without RFETS Pu or LANL Pu Subalternative is similar to the Upgrade With RFETS Pu Pits Subalternative because the modified facilities in Zone 12 South would be designed with adequate capacity to store all of the RFETS Pu pits. No additional resources would be required and therefore the impacts would be the same.

Upgrade With All or Some Rocky Flats Environmental Technology Site Plutonium and Los Alamos National Laboratory Plutonium Subalternative

Modify Existing Zone 12 South Facilities for Continued Plutonium Storage

Construction to upgrade the existing storage facility to accommodate long-term storage of existing quantities of Pantex, RFETS Pu, and LANL Pu material would have minimal impacts on the site infrastructure. Data for construction and operations presented in Appendix C are much larger than expected and are bounded by the Construct New and Modify Existing Zone 12 South Facilities Collocation Option. As shown in Table 4.2.4.2–1, other than some added roadway, the operational infrastructure resource requirements are within site capacities.

Since impacts associated with storing all of the RFETS Pu and LANL Pu material at Pantex for long-term storage are minimal for construction and can be managed for operations, storing only a portion of the RFETS Pu and LANL Pu material at Pantex would result in minimal impacts to the site infrastructure as well. [Text deleted.]

Consolidation Alternative

Construct New and Modify Existing Zone 12 South Facilities

Construction to modify the existing storage facility to consolidate long-term storage of Pu would have minimal impacts on the site infrastructure. Data for construction are presented in Appendix C. As shown in Table 4.2.4.2-1, some additional roadway would be required; the electrical and fuel infrastructure requirements for operations are within site capacities. [Text deleted.]

Construct New Plutonium Storage Facility

Construction of a new facility to consolidate long-term storage of Pu would have minimal impacts on the site infrastructure. Data for construction are presented in Appendix C. As shown in Table 4.2.4.2-1, some additional roadway would be required; the electrical and fuel infrastructure requirements for operations are within site capacities.

Collocation Alternative

Construct New Plutonium and Highly Enriched Uranium Storage Facilities

Construction for the collocated Pu and HEU storage facilities would have minimal impacts on the site infrastructure. Data for construction are presented in Appendix C. As shown in Table 4.2.4.2-1, some additional roadway would be required; the electrical and fuel infrastructure requirements for operations are within site capacities.

Subalternative Not Including Strategic Reserve and Weapons Research and Development Materials

Since the existing Pantex site infrastructure would be capable of supporting construction/modification and operation of facilities for the No Action, Upgrade, Consolidation, or Collocation Alternatives, operating such facilities without including provisions for storage of strategic reserve and weapons R&D materials could be accommodated as well. Expected reductions in amounts of annual electrical energy requirements for the various storage facilities are the only site infrastructure changes expected if this subalternative is chosen because electric usage is dependent on the amount of material. [Text deleted.]

Phaseout

Pantex would be left with its weapons assembly/disassembly and HE fabrication missions. There would be no effects on the site infrastructure.

4.2.4.3 Air Quality and Noise

Construction and operation activities associated with the No Action Alternative and the proposed storage alternatives would generate criteria and toxic/hazardous pollutants. To evaluate the air quality impacts at Pantex, criteria and toxic/hazardous concentrations from the No Action Alternative and the storage alternatives are compared with Federal and State standards and guidelines. Impacts from radiological airborne emissions are described in Section 4.2.4.9.

In general, all of the proposed storage facilities would emit the same types of air pollutants during construction. It is expected emissions would not exceed Federal, State, or local air quality regulations. PM₁₀ and TSP concentrations will be increased, especially during peak construction periods.

The principal sources of emissions during construction include the following:

- Fugitive dust from land clearing, site preparation, excavation, and wind erosion of exposed ground surfaces
- Exhaust and road dust generated by construction equipment, vehicles delivering construction materials, and vehicles carrying construction workers

During operation, impacts from each of the individual storage facilities with respect to the concentrations of criteria and toxic/hazardous air pollutants are predicted to be in compliance with Federal, State, and local air quality regulations or guidelines. Table 4.2.4.3–1 presents the estimated pollutant concentrations for each of the fissile materials storage alternatives, indicating little difference between alternatives with respect to impacts to air quality.

Emission rates attributed to operation of the proposed storage facilities are presented in Tables F.1.3–1 to F.1.3–3. [Text deleted.] Air pollutant emission sources associated with operations include the following:

- Operation of existing boilers for space heating
- Operation of diesel generators and periodic testing of emergency diesel generators
- Exhaust and road dust generated by vehicles delivering supplies and bringing employees to work
- Toxic/hazardous pollutant emissions from facility processes

Noise impacts during either construction or operation are expected to be low. Air quality and noise impacts for each storage alternative are described separately. Supporting data for the air quality and noise analyses are presented in Appendix F.

AIR QUALITY

An analysis was conducted of the potential air quality impacts of emissions from each of the storage alternatives as described in Section 4.1.3.

Section 176 (c) of the 1990 CAA Amendments requires that all Federal actions conform with the applicable SIP. EPA has implemented rules that establish the criteria and procedures governing the determination of conformity for all Federal actions in nonattainment and maintenance areas. These are discussed in Section 4.1.3. The attainment status of the area in which Pantex is located is discussed in Section 3.5.3. Since the area is considered to be an attainment area for criteria pollutants the proposed actions at this site do not require that a conformity analysis be performed.

No Action Alternative

This alternative utilizes estimated air emissions data from total site operations at Pantex assuming continuation of site missions as described in Section 3.5. These data reflect conservative estimates of criteria and toxic/hazardous emissions at Pantex. The emission rates for the criteria and toxic/hazardous pollutants for No Action for the total site are presented in Table F.1.2.5–1. Table 4.2.4.3–1 presents the No Action concentrations. During dry and windy conditions, increased PM₁₀ and TSP concentrations may occur due to ongoing construction associated with other activities (that are outside of the scope of this PEIS) under the No Action Alternative. Concentrations of all criteria and toxic/hazardous air pollutants at the site boundary or public access highways are expected to remain within applicable Federal, State, and local ambient air quality standards.

Upgrade Alternative

Preferred Alternative: Upgrade With Rocky Flats Environmental Technology Site Plutonium Pits Subalternative

Modify Existing Zone 12 South Facilities for Continued Plutonium Storage

Increased PM₁₀ and TSP concentrations may occur during the peak construction period, particularly during dry and windy conditions. Appropriate control measures would be followed to minimize pollutant concentrations during construction. Concentrations of all pollutants at the site boundary or public-access highways would remain within applicable Federal and State ambient air quality standards during construction.

During operation, concentrations of criteria and toxic/hazardous air pollutants are predicted to be in compliance with Federal, State, and local air quality regulations or guidelines. Estimated pollutant concentrations attributable to increased operations associated with this storage alternative, plus the No Action concentrations, are presented in Table 4.2.4.3–1.

Upgrade Without Rocky Flats Environmental Technology Site Plutonium or Los Alamos National Laboratory Plutonium Subalternative

Modify Existing Zone 12 South Facilities for Continued Plutonium Storage

The Upgrade Without RFETS Pu or LANL Pu Subalternative is similar to the Upgrade With RFETS Pu Pits Subalternative because the modified facilities in Zone 12 South would be designed with adequate capacity to store all of the RFETS Pu pits. No additional resources would be required and therefore the impacts would be the same.

Upgrade With All or Some Rocky Flats Environmental Technology Site Plutonium and Los Alamos National Laboratory Plutonium Subalternative

Modify Existing Zone 12 South Facilities for Continued Plutonium Storage

Air quality impacts for construction and operation for this subalternative are expected to be similar to those for the Consolidation Alternative Construct New and Modify Existing Zone 12 South Facilities Option for Pantex.

Consolidation Alternative

Construct New and Modify Existing Zone 12 South Facilities

Increased PM₁₀ and TSP concentrations may occur during the peak construction period, particularly during dry and windy conditions. Appropriate control measures would be followed to minimize pollutant concentrations

during construction. Concentrations of all pollutants at the site boundary would remain within applicable Federal and State ambient air quality standards.

During operation, concentrations of criteria and toxic/hazardous air pollutants are predicted to be in compliance with Federal, State, and local air quality regulations or guidelines. Estimated pollutant concentrations attributable to increased operations associated with this storage alternative, plus the No Action concentrations, are presented in Table 4.2.4.3–1.

Construct New Plutonium Storage Facility

In addition to the types of sources of emissions during construction associated with the No Action Alternative and the Upgrade Alternative, fugitive dust resulting from the operation of a concrete batch plant would be an additional emission source associated with this storage alternative.

Increased PM₁₀ and TSP concentrations may occur during the peak construction period for the new storage facility option, particularly during dry and windy conditions. Appropriate control measures would be followed to minimize pollutant concentrations during construction. Concentrations of all pollutants at the site boundary would remain within applicable Federal and State ambient air quality standards during construction.

During operation, impacts with respect to the concentrations of criteria and toxic/hazardous air pollutants are predicted to be in compliance with Federal, State, and local air quality regulations or guidelines. Estimated pollutant concentrations attributable to increased operations associated with this storage alternative, plus the No Action concentrations, are presented in Table 4.2.4.3–1.

Collocation Alternative

Construct New Plutonium and Highly Enriched Uranium Storage Facilities

The collocation of Pu and HEU facilities would be located in the same area as the consolidation of Pu facility and would have similar air quality impacts, with the following exceptions. During operation, emissions would be higher, as shown in Appendix F. Concentrations of criteria and toxic/hazardous air pollutants are predicted to be in compliance with Federal, State, and local air quality regulations or guidelines. Estimated pollutant concentrations attributable to increased operations associated with this storage alternative, plus the No Action concentrations, are presented in Table 4.2.4.3–1.

Subalternative Not Including Strategic Reserve and Weapons Research and Development Materials

Air quality impacts for construction and operation for this option are expected to be similar to those described previously for the No Action Alternative, the Upgrade Alternative, the Consolidation Alternative, and the Collocation Alternative. [Text deleted.]

Phaseout

Phaseout of existing Pu inventories as a result of consolidating Pu at another site is expected to result in a small reduction in air pollutant concentrations from the No Action concentrations and would be in compliance with Federal and State standards.

NOISE

The location of the proposed storage facilities relative to the site boundary and sensitive receptors was examined to evaluate the potential for onsite and offsite noise impacts. Noise sources during construction may include

heavy construction equipment and increased traffic. Increased traffic would occur onsite and along offsite local and regional transportation routes used to bring construction material and workers to the site.

No Action Alternative

Nontraffic noise sources associated with continued storage and other ongoing missions are the same as described in Chapter 3. The continuation of operations at Pantex would result in no appreciable change in traffic noise and onsite operational noise sources from current levels. Nontraffic noise sources are located at sufficient distance from offsite areas that the contribution to offsite noise levels would continue to be small. Due to the size of the site, noise emissions from construction equipment and operations activities would not be expected to cause annoyance to the public. Some noise sources may be located close enough to onsite noise sensitive areas to result in impacts, such as disturbance of wildlife.

Upgrade (Preferred Alternative), Consolidation, and Collocation Alternatives

Nontraffic noise sources associated with the storage Upgrade Alternative would be similar to those for existing facilities as discussed in Chapter 3. Nontraffic, operational noise sources associated with the consolidation of Pu and collocation of Pu and HEU alternatives include additional equipment and machines (cooling systems, vents, motors, and material handling equipment). These noise sources would be located at sufficient distance from offsite areas that the contribution to offsite noise levels would be small. Due to the size of the site, noise emissions from construction equipment and operations activities would not be expected to cause annoyance to the public. Some noise sources may result in impacts, such as disturbance of wildlife.

Subalternative Not Including Strategic Reserve and Weapons Research and Development Materials

Noise impacts for construction and operations for this option are expected to be almost the same as those previously described for the No Action Alternative, the Upgrade Alternative, the Consolidation Alternative, and the Collocation Alternative because noise impacts are based on the use of the facility and not the size. [Text deleted.]

Phaseout

A reduction in noise levels may result from the phaseout of storage facilities.

4.2.4.4 Water Resources

Construction and operation of the proposed long-term storage facilities at Pantex would affect water resources. All water required for construction or operation would be supplied from groundwater. The Ogallala Aquifer, which would be used to accommodate water requirements, has been projected to be adequate up to the year 2040 by TNRCC. The proposed facilities would be located outside the 100- and 500-year floodplain. During construction, treated sanitary wastewater would be discharged to the playas. During operations, all wastewater would be treated and either recycled or discharged to the playas. No wastewater would be discharged to non-playa surface waters during operation of the facilities. Thus, impacts to surface water quality are not expected. Stormwater runoff would be collected and treated, if necessary, before discharge to natural drainage channels. [Text deleted.] Table 4.2.4.4–1 presents No Action water resources uses and discharges and the potential changes to water resources at Pantex resulting from the long-term storage alternatives.

No Action Alternative

Surface Water. [Text deleted.] A description of the activities that would continue at Pantex is provided in Section 3.5. No demands on surface water supplies would occur. However, current wastewater discharges to Playas 1, 2, and possibly 4 of 478 million l/yr (126 million gal/yr) would decrease to approximately 141 million l/yr (37.3 million gal/yr) by the year 2005. Since surface water is not used at Pantex, there would be no impacts to surface water availability or quality from the this alternative.

Groundwater. Under this alternative, baseline conditions and operations, described in Section 3.5.4, would continue at the plant, and current groundwater usage of 836 million l/yr (221 million gal/yr) would decrease to 249 million l/yr (65.7 million gal/yr) by the year 2005. Groundwater used would continue to be withdrawn from the Ogallala Aquifer through wells located on the Pantex property. Under this alternative current groundwater restoration and characterization studies would continue. As part of the restoration activities for the perched aquifer, contaminated groundwater is pumped, treated, and reinjected back into this aquifer. This remediation effort should improve the quality of the perched aquifer groundwater. [Text deleted.]

Upgrade Alternative

Preferred Alternative: Upgrade With Rocky Flats Environmental Technology Site Plutonium Pits Subalternative

Modify Existing Zone 12 South Facilities for Continued Plutonium Storage

Surface Water. There are no unique construction characteristics associated with water requirements and discharges from this alternative. No surface water would be withdrawn for any construction or operation activities associated with any of the proposed Pu storage upgraded facilities. Therefore, there would be no impacts to surface water availability. Nonhazardous wastewater generated during construction and operation of the upgraded Pu storage facilities would either be recycled or treated and released to the playas under the permit requirements. Approximately 3.1 million l/yr (0.83 million gal/yr) of nonhazardous wastewater would be generated during the construction phase. In 1994, Pantex averaged approximately 1.4 million l/day (370,000 gal/day) of wastewater discharge to the playas. This quantity is expected to decrease in the future. Discharge of this additional wastewater to playas would not result in exceedance of the TNRCC-permitted monthly average maximum limit of 2.46 million l/day (650,000 gal/day).

During operation, utility, process, and sanitary wastewater and cooling system blowdown for the upgraded Pu storage facilities would either be recycled or treated and discharged into playas. Approximately 12.9 million l/yr (3.4 million gal/yr) of sanitary wastewater would be processed using existing and planned liquid nonhazardous waste facilities during operation; exceedance of the discharge limitation is not expected. This amount would

represent a 9.1 percent increase in the amount being discharged. The treated effluent would be monitored to comply with the requirements. The extent to which treated effluent or stormwater would be recycled for reuse within the facility would be determined during site-specific studies.

The facility to be upgraded is located in Zone 12. Since 100-year, 500-year, or standard project flood boundaries are not located in Zone 12, there will be no impacts to floodplains. No construction would occur in areas delineated as 100-year floodplains.

Groundwater. All water required for construction and operation would be supplied from groundwater. The Ogallala Aquifer, which is the source of water for operations at Pantex, has been projected to be adequate up to the year 2040 by the TNRCC. Construction and operation water requirements for the upgraded Pu storage facilities are small relative to the total water in aquifer storage, which for the year 2010 has been estimated at 287 trillion l (76 trillion gal) (PX WDB 1993a:1). As shown in Table 4.2.4.4-1, construction of the proposed upgraded facilities would require 6.4 million l/yr (1.7 million gal/yr) of water, which represents approximately a 2.6-percent increase over the projected No Action groundwater usage. Regional groundwater levels would have minimal impacts.

Previous studies have shown that when the Amarillo City Well Field pumped 18.5 billion l/yr (4.9 billion gal/yr) from the Ogallala aquifer, an average of 1.8-m/yr (5.9-ft/yr) decline in the water table occurred over a 10-year period in the local well field area. This water level decline caused a shift in the groundwater flow direction beneath Pantex. Operating the proposed upgraded Pu storage facilities at Pantex would require 27.5 million l/yr (7.3 million gal/yr), resulting in a minimal drawdown representing 1.4 percent of the available groundwater (1,900 million l/yr [502 million gal/yr]). This additional groundwater withdrawal would cumulatively add to the existing decline in water levels of the Ogallala Aquifer. However, there should be minimal impacts to regional groundwater levels from this additional withdrawal. The total water withdrawal including this alternative would be 276.4 million l/yr (73 million gal/yr) which, because of expected cutbacks in other programs, would be 67 percent less than what is currently being withdrawn (836 million l/yr [221 million gal/yr]) from the Ogallala Aquifer by Pantex.

Construction and operation of the proposed upgraded Pu storage facilities would not result in direct discharges to groundwater, so contamination of the Ogallala Aquifer is not expected. Treated wastewater discharged to playas, however, could percolate downward into the groundwater of the near surface aquifer. This water would be monitored according to requirements and would not be discharged to the playas until contaminant levels were within the limits specified by the TNRCC. Since the supply wells located in the area withdraw potable water from the deep Ogallala Aquifer, the existing plume in the near-surface aquifer should not be affected by the upgraded Pu storage facilities. Pantex will continue to evaluate groundwater contamination in both the perched and Ogallala aquifers.

Upgrade Without Rocky Flats Environmental Technology Site Plutonium or Los Alamos National Laboratory Plutonium Subalternative

Modify Existing Zone 12 South Facilities for Continued Plutonium Storage

The Upgrade Without RFETS Pu or LANL Pu Subalternative is similar to the Upgrade With RFETS Pu Pits Subalternative because the modified facilities in Zone 12 South would be designed with adequate capacity to store all of the RFETS Pu pits. No additional resources would be required and therefore the impacts would be the same.

Upgrade With All or Some Rocky Flats Environmental Technology Site Plutonium and Los Alamos National Laboratory Plutonium Subalternative

Modify Existing Zone 12 South Facilities for Continued Plutonium Storage

The annual water requirements during construction and operation are 80 million l/yr (21.1 million gal/yr) and 110 million l/yr (29.1 million gal/yr), respectively. These additional requirements represent 32.1- and 44.2-percent increases, respectively, in the projected No Action withdrawals from the Ogallala Aquifer. The quantity required for operation represents 5.8 percent of the available groundwater (1,900 million l/yr [502 million gal/yr]). This additional groundwater withdrawal would cumulatively add to the existing decline in water levels of the Ogallala Aquifer. However, there should be minimal impacts to regional groundwater levels from this additional withdrawal. The total water withdrawal including this alternative would be 359 million l/yr (94.8 million gal/yr), which, because of expected cutbacks in other programs, would be 57 percent less than what is currently being withdrawn (836 million l/yr [221 million gal/yr]) from the Ogallala Aquifer by Pantex.

Consolidation Alternative

Construct New and Modify Existing Zone 12 South Facilities

The water resource requirements and impacts for this alternative are identical to those discussed above for the Upgrade With All or Some RFETS Pu and LANL Pu Subalternative.

Construct New Plutonium Storage Facility

The Pu storage facility would be located in Zone 12 South. The impacts associated with this option are the same as those discussed above for the Pu consolidate through upgrading, with the following exceptions. The water requirements of this option are slightly less than those for consolidate through upgrading with RFETS and LANL material. This option would require approximately 85 million l/yr (22.5 million gal/yr) and 98 million l/yr (26 million gal/yr) of water for construction and operation, respectively. These additional requirements represent 34.1- and 39.4-percent increases, respectively, in the projected annual No Action withdrawals from the Ogallala Aquifer. [Text deleted.] The total water withdrawal including this alternative would be 347 million l/yr (91.7 million gal/yr), which, because of expected cutbacks in other programs, would be 58 percent less than what is currently being withdrawn (836 million l/yr [221 million gal/yr]) from the Ogallala Aquifer by Pantex.

Sanitary wastewater quantities generated during construction of this option would be the same as for the previous option and are approximately 8.0 million l/yr (2.1 million gal/yr). These effluents would be discharged to the playas under the permit. The maximum quantity of additional wastewater (approximately 0.03 million l/day [7,900 gal/day]) would not cause any exceedances of the maximum limit of 3.1 million l/day (820,000 gal/day). During operations, wastewater would be recycled. Since surface water would not be used for this option, no impacts to surface water availability would occur.

Collocation Alternative

Construct New Plutonium and Highly Enriched Uranium Storage Facilities

Because the collocated storage facilities would be located in the same area as the new Pu storage facility (Zone 12 of Pantex), the impacts associated with it are the same as those discussed above, with the following exceptions. The water requirements for construction and operation of this option are greater than those for the previous options. This option would require approximately 104.7 million l/yr (27.7 million gal/yr) and 130 million l/yr (34 million gal/yr) for construction and operation, respectively. These additional requirements

represent 42- and 52.2-percent increases, respectively, in the projected No Action annual groundwater withdrawals from the Ogallala Aquifer and would be 5.5- and 6.8-percent of the available groundwater (1,900 million l/yr [502 million gal/yr]). [Text deleted.] The total water withdrawal including this alternative would be 379 million l/yr (100 million gal/yr) which would be 55 percent less than what is currently being withdrawn (836 million l/yr [221 million gal/yr]) from the Ogallala Aquifer by Pantex.

Sanitary wastewater quantities generated during construction would be approximately 12.2 million l/yr (3.2 million gal/yr); this water would be treated and discharged to the playas. For the same reasons as discussed for the previous option, no exceedances of the discharge limit would be expected. During operations, all wastewater would be recycled, causing no impacts.

Although the expected drawdowns caused by withdrawing the water required for the potential long-term Pu storage options are relatively small, the overall decline of groundwater levels in the Amarillo area is of concern. Groundwater conservation measures that could be considered include limiting groundwater production hours, installing dripless faucets, and reusing process water. In addition, to alleviate some of the effects from pumping groundwater from the Ogallala Aquifer, the city of Amarillo is considering supplying treated wastewater to Pantex for industrial use from the Hollywood Road Wastewater Treatment Plant. However, details of this mitigation measure have not been determined. Mitigation measures to reduce wastewater seepage and protect groundwater quality could include building lined evaporation ponds.

Subalternative Not Including Strategic Reserve and Weapons Research and Development Materials

Water resource impacts for construction and operation for this subalternative are expected to be slightly less than those discussed for the No Action Alternative, the Upgrade Alternative, the Consolidation Alternative, and the Collocation Alternative because of the reduction in the amount of material. [Text deleted.]

Phaseout

If the current Pu storage mission at Pantex is phased out, groundwater withdrawals from the Ogallala aquifer and nonhazardous wastewater discharge to playas would decrease by negligible quantities. By decreasing groundwater withdrawals, however, Pantex would lessen its contribution to the declining groundwater levels of the Ogallala Aquifer by a very small amount. Reducing wastewater discharges to the playas by this quantity should not cause any noticeable impacts.

[Text deleted.]

4.2.4.5 Geology and Soils

Construction and operation of the alternatives at Pantex would have no impact on the geologic resources. A low seismic risk exists, but it would be considered in the design of the proposed alternatives. The existing seismic risk does not preclude the safe construction and operation of the proposed alternative facilities. The facilities would be designed for earthquake-generated ground acceleration in accordance with DOE O 420.1, *Facility Safety*. Because there are no known capable faults at Pantex, the potential for ground rupture as a result of an earthquake during the life of the facility is minimal; ground shaking is more likely. Intensities of more than IV on the MMI scale are not likely at Pantex. Ground shaking could affect the integrity of inadequately designed or nonreinforced structures but would not affect newly designed facilities. Human health effects from accidents initiated by natural phenomena (for example, earthquakes) are discussed in Section 4.2.4.9. Volcanic activity is not anticipated to affect the construction and operation of the alternatives. It is also unlikely that landslides or other nontectonic events would affect the proposed alternatives. Salt dissolution is an active process in the southern High Plains area. However, no surficial expression of sinkholes or fractures associated with salt dissolution have been identified in Carson County. Potential effects due to subsidence, are negligible because salt dissolution is a slow process relative to human activities. Properties and conditions of soils underlying Pantex typically have no limitations on construction with the exception of moderate to severe shrink-swell potential in nearly all areas of Pantex. This factor would be considered in facility design and site preparation. No economically viable geologic resources are known to be present at Pantex.

Impacts to the geologic and soil resource occur during, or as a result of, ground-disturbing construction activities. Construction of the alternatives may involve ground-disturbing activities which could impact the soil resources. The amount of land disturbed is specified below for each alternative. Impacts would depend on the specific soil units in the disturbed area, the extent of land disturbing activities, and the amount of soil disturbed. Within Pantex, the soil erosion potential is directly related to the amount of land disturbed because soil and climatic conditions are similar throughout the site. Control measures would be employed to minimize soil erosion.

[Text deleted.]

No Action Alternative

[Text deleted.] Under the No Action Alternative, DOE would continue current and ongoing activities at Pantex. There would be no ground-disturbing activities beyond those associated with existing and future site improvements. Because no new construction and the associated ground disturbance for potential soil erosion would occur, the No Action Alternative would have no effect on the geologic or soil resources at the site.

Upgrade Alternative

Preferred Alternative: Upgrade With Rocky Flats Environmental Technology Site Plutonium Pits Subalternative

Modify Existing Zone 12 South Facilities for Continued Plutonium Storage

No apparent direct or indirect effects on the geologic resource are anticipated, because neither facility construction and operational activities nor site infrastructure improvements will limit access to potential geologic resources.

Construction activities will occur completely on previously disturbed land, as described in Section 4.2.4.1. The soil disturbance during construction activities would be approximately 0.18 ha (0.45 acres). Soil disturbance would occur primarily from ground-disturbing construction activities (foundation preparation) and activities associated with building construction laydown areas that can expose the soil profile and lead to a possible

increase in soil erosion as a result of wind and water action. Soil loss would depend on the frequency and severity of rain, wind velocities (increases in wind velocity and duration increase potential soil erosion), and the size, location, and duration of ground-breaking activities.

Net soil disturbance during operations would be considerably less than during construction because areas temporarily used for construction laydown would be restored. Although stormwater runoff and wind action could occur during operations, they are anticipated to be minimal.

Upgrade Without Rocky Flats Environmental Technology Site Plutonium or Los Alamos National Laboratory Plutonium Subalternative

Modify Existing Zone 12 South Facilities for Continued Plutonium Storage

The Upgrade Without RFETS Pu or LANL Pu Subalternative is similar to the Upgrade With RFETS Pu Pits Subalternative because the modified facilities in Zone 12 South would be designed with adequate capacity to store all of the RFETS Pu pits. No additional resources would be required and therefore the impacts would be the same.

Upgrade With All or Some Rocky Flats Environmental Technology Site Plutonium and Los Alamos National Laboratory Plutonium Subalternative

Modify Existing Zone 12 South Facilities for Continued Plutonium Storage

Construction and operation effects on geological and soil resources would be the same as those described for the Upgrade With RFETS Pu Pits Subalternative. The soil disturbance during construction activities would be approximately 0.18 ha (0.45 acres) and would occur completely on previously disturbed land. This disturbance would affect the soil profile and lead to a possible temporary increase in erosion as a result of stormwater runoff and wind action. Soil impacts during operation are expected to be minimal. An analysis of the operational effects on the soil resource is provided in the Upgrade With RFETS Pu Pits Subalternative.

Consolidation Alternative

Construct New and Modify Existing Zone 12 South Facilities

No apparent direct or indirect effects on the geologic resource are anticipated because neither facility construction and operational activities nor site infrastructure improvements will restrict access to potential geologic resources.

[Text deleted.] Construction of the storage facilities would occur on previously disturbed land as described in Section 4.2.4.1. However, under this alternative additional soil impacts are anticipated because it has greater construction and operating land use requirements. Approximately 60.5 ha (149 acres) would be disturbed for construction of the Consolidation Alternative. This disturbance would affect the soil profile and lead to a possible temporary increase in erosion as a result of stormwater runoff and wind action. Analysis of operational effects in this section is the same as that provided for the Upgrade Alternative.

Construct New Plutonium Storage Facility

[Text deleted.] Construction of the storage facility would occur on previously disturbed land as described in Section 4.2.4.1. Approximately 58.5 ha (144 acres) of land would be disturbed for the new facility, affecting the soil profile and leading to a possible temporary increase in erosion as a result of stormwater runoff and wind action. [Text deleted.]

Collocation Alternative

Construct New Plutonium and Highly Enriched Uranium Storage Facilities

No apparent direct or indirect effects on the geologic resource are anticipated, because neither facility construction and operational activities nor site infrastructure improvements will restrict access to potential geologic resources.

Construction and operation effects on geology and soil resources for the Collocation Alternative would be similar to those described for the Consolidation Alternative. However, additional soil impacts would be expected from the construction of the storage facilities that will occur completely on previously disturbed land. During construction, approximately 89.5 ha (221 acres) would be required for the new facilities, affecting the soil profile and leading to a possible temporary increase in erosion as a result of stormwater runoff and wind action. Soil impacts during operation are expected to be minimal.

Subalternative Not Including Strategic Reserve and Weapons Research and Development Materials

Exclusion of strategic reserve and weapons R&D materials would give almost the same effects to the geological and soil resources for the No Action Alternative, the Upgrade Alternative, the Consolidation Alternative, and the Collocation Alternative. By excluding these materials the size of a facility would be similar, thus not changing the amount of land disturbed by construction activities. No effect to the geologic resource is anticipated as a result of this subalternative.

Phaseout

The phaseout of storage capacity would have no apparent effects on the geology and soil resource. However, phaseout could result in beneficial effects on the soils of the area. Hazardous, radioactive, and mixed waste sources would be eliminated from the area, thus decreasing the potential for future soil contamination.

[Text deleted.]

4.2.4.6 Biological Resources

No Action Alternative

Under No Action, the Pu storage mission described in Section 2.2.4 would continue at Pantex. This activity would result in no appreciable change to current conditions of biological resources at Pantex as described in Section 3.5.6.

Upgrade Alternative

Preferred Alternative: Upgrade With Rocky Flats Environmental Technology Site Plutonium Pits Subalternative

Modify Existing Zone 12 South Facilities for Continued Plutonium Storage

Upgrading the existing Pu storage facility at Pantex would cause minimal disturbance to biological resources. This is the case since all activities would take place within an area that is currently disturbed by site structures. Noise associated with construction could cause some temporary disturbance to wildlife, but this impact would be minimal since animals living adjacent to the developed area have already adapted to its presence. Impacts to wetlands and aquatic resources would not occur since these resources are not found in the upgrade area. Since the upgrade would take place within a developed area, impacts to threatened and endangered species would not be expected.

Upgrade Without Rocky Flats Environmental Technology Site Plutonium or Los Alamos National Laboratory Plutonium Subalternative

Modify Existing Zone 12 South Facilities for Continued Plutonium Storage

The Upgrade Without RFETS Pu or LANL Pu Subalternative is similar to the Upgrade With RFETS Pu Pits Subalternative because the modified facilities in Zone 12 South would be designed with adequate capacity to store all of the RFETS Pu pits. No additional resources would be required and therefore the impacts would be the same.

Upgrade With All or Some Rocky Flats Environmental Technology Site Plutonium and Los Alamos National Laboratory Plutonium Subalternative

Modify Existing Zone 12 South Facilities for Continued Plutonium Storage

Upgrading with all or some RFETS and LANL material would not be expected to change impacts to biological resources from those described for the Upgrade With RFETS Pu Pits Subalternative.

Consolidation Alternative

Construct New and Modify Existing Zone 12 South Facilities

Under this alternative, Pu would be consolidated in a modified existing facility at Pantex requiring some new construction. Modification of existing facilities would occur on previously disturbed land and, therefore, would cause minimal disturbance to biological resources. Noise associated with construction could cause some temporary disturbance to wildlife, but this impact would be minimal since animals living adjacent to the developed area have already adapted to its presence. Construction-related ground disturbance may increase the potential for sediment runoff effects to playa wetlands and aquatic habitat. This impact would be controlled through the implementation of standard soil erosion and sediment control measures. Since this alternative

occurs within a developed area, impacts to threatened and endangered species would not be expected. Consultation with USFWS and State agencies would be conducted at the site-specific level, as appropriate. [Text deleted.]

[Text deleted.]

Construct New Plutonium Storage Facility

Impacts to biological resources from a new storage facility would be nearly the same as those described for the construction of a new facility and the modification of an existing facility alternatives addressed above. This is the case since both options would be located in the same general area of the Pantex site and both would occur on previously disturbed land. [Text deleted.]

Collocation Alternative

Construct New Plutonium and Highly Enriched Uranium Storage Facilities

Under this alternative, Pu material would be stored with HEU inventories in a new collocated storage facility at Pantex. Construction and operation of collocated storage facilities would occur on previously disturbed land and therefore would cause minimal disturbance to biological resources similar to, but somewhat greater than those described for the consolidated storage facility alone. [Text deleted.]

Subalternative Not Including Strategic Reserve and Weapons Research and Development Materials

The exclusion of strategic reserve and weapons R&D materials would have almost the same effects to the No Action Alternative, the Upgrade Alternative, the Consolidation Alternative, and the Collocation Alternative. The size of the facility would be similar and would not result in the reduction of disturbed habitat and/or fewer facility modifications and the potential impacts to biological resources would be similar. [Text deleted.]

Phaseout

During phaseout of Pu storage facilities at Pantex, short-term increased human activity could disturb some wildlife species on the site. Following phaseout activities, the wildlife populations would be expected to return to pre-phaseout size and location. The only effect to wetlands and aquatic resources would be a slight reduction of wastewater discharge to playas.

4.2.4.7 Cultural and Paleontological Resources

No Action Alternative

Under this alternative, DOE would continue the existing and planned missions at Pantex. Pantex material (pits) would continue to be stored in Zone 4 Magazines pursuant to DNFSB Recommendation 94-1. Any impacts to cultural or paleontological resources from these missions would be independent of the proposed action and would be addressed through separate NHPA, *American Indian Religious Freedom Act*, and *Native American Graves Protection and Repatriation Act* regulatory compliance procedures. DOE is developing an interim Programmatic Agreement that will be ready by FY97. This Agreement will be superseded by the Cultural Resources Management Plan for Pantex, which is scheduled for implementation in 1998. Currently, cultural resources are managed through existing interim procedures according to Sections 106 and 110 of the NHPA. A Native American outreach program has also been initiated.

Upgrade Alternative

Preferred Alternative: Upgrade With Rocky Flats Environmental Technology Site Plutonium Pits Subalternative

Modify Existing Zone 12 South Facilities for Continued Plutonium Storage

This option involves the expansion of existing Building 12-66 in Zone 12 and the use of Buildings 12-82, 12-116, and 12-117 and associated ramps. Building 12-66 is not considered NRHP-eligible based on an evaluation of World War II Era structures at Pantex (PX LRA 1994a:125). However, determinations of NRHP-eligible Cold War Era structures have not been completed, and some structures in Zone 12 may be determined eligible on that basis. The zone is developed and disturbed and probably does not contain any intact archaeological deposits, so no impacts to prehistoric or historic sites are anticipated, even on lands used for equipment laydown or construction parking. Minimal impacts to Native American or paleontological resources are expected to result from this option. Land disturbance during building modification is expected to be 0.18 ha (0.45 acres) and the land required during operation would total 0.1 ha (0.25 acres). Impacts to cultural or paleontological resources are expected to be minimal.

Upgrade Without Rocky Flats Environmental Technology Site Plutonium or Los Alamos National Laboratory Plutonium Subalternative

Modify Existing Zone 12 South Facilities for Continued Plutonium Storage

The Upgrade Without RFETS Pu or LANL Pu Subalternative is similar to the Upgrade With RFETS Pu Pits Subalternative because the modified facilities in Zone 12 South would be designed with adequate capacity to store all of the RFETS Pu pits. No additional resources would be required and therefore the impacts would be the same.

Upgrade With All or Some Rocky Flats Environmental Technology Site Plutonium and Los Alamos National Laboratory Plutonium Subalternative

Modify Existing Zone 12 South Facilities for Continued Plutonium Storage

This subalternative involves modification to the previously mentioned facilities. Land disturbance during building modification, construction, and operation is expected to be the same as required for the other upgrade subalternative. Impacts to cultural or paleontological resources are expected to be minimal.

Consolidation Alternative

Construct New and Modify Existing Zone 12 South Facilities

New construction and building modification would occur on previously disturbed land in Zone 12 South. A reduced-access buffer zone would exist around the facility. Buildings 12-66 and 12-82 would be modified. [Text deleted.] Although it is possible that subsurface remains exist within Pantex, the project area is disturbed and probably does not contain any intact archaeological sites. Consequently, impacts to prehistoric or historic resources are not anticipated. Additional surveys may be necessary for compliance with the NHPA. Should any resources be discovered during construction, mitigation measures would be taken in consultation with the Texas SHPO. [Text deleted.]

The DOE has begun a public outreach program to involve Native American groups in decisionmaking related to land use and cultural resources. [Text deleted.] Facility operation can have an auditory or visual impact on sacred or ceremonial sites. To date, none of the Native American tribes known to have traditional interest in Pantex lands have identified any traditional cultural resources at Pantex. Additional consultation may identify some of these resources.

Construct New Plutonium Storage Facility

This option involves consolidation through new construction on land in Zone 12 South. It would be constructed on previously disturbed land. A reduced-access buffer zone would be created around the facility. The same potential for impacts to cultural and paleontological resources from the construction and operation of the proposed facility exists as described under the previous consolidation option.

Collocation Alternative

Construct New Plutonium and Highly Enriched Uranium Storage Facilities

The proposed action is to construct a new facility on previously disturbed land in Zone 12 South to accommodate all Pu and HEU material within the scope of the PEIS. A buffer zone would be created around the facility. Impacts to cultural and paleontological resources resulting from this alternative would be similar to those described under the Consolidation Alternative.

Subalternative Not Including Strategic Reserve and Weapons Research and Development Materials

Under this subalternative, facility and other resource requirements will be almost the same as the No Action Alternative, the Upgrade Alternatives, the Consolidation Alternative, and the Collocation Alternative. Therefore, the impacts to cultural and paleontological resources would be equal to those previously described. [Text deleted.]

Phaseout

Under this alternative, Pantex Pu material would be moved to the consolidation or collocation sites or to disposition. No impacts to cultural or paleontological resources are expected to result from this action.

[Text deleted.]

4.2.4.8 Socioeconomics

No Action Alternative

Under this alternative, the existing storage facility would remain operational. No new employment or in-migration of workers would be required.

Regional Economy Characteristics. Total employment growth in the REA is projected to average less than 1 percent annually between 1995 and 2040. Total employment is projected to reach 221,800 in 2000 and increase to 254,400 in 2040. Unemployment in the REA was 4.8 percent in 1994 and is projected to remain at this level into the near future. Per capita income is projected to increase from approximately \$19,435 in 1995 to \$22,671 in 2040. Projections for the No Action alternative are presented in Table L.1-37.

Population and Housing. Population in the ROI is projected to increase from 206,400 in 1995 to 240,800 by 2040. The total number of housing units in the ROI is projected to increase from 85,400 in 1995 to 99,600 by 2040. Population and housing projections for the No Action Alternative are presented in Appendix Tables L.1-38 and L.1-39, respectively.

Community Services. Education, public safety, and health care characteristics are used to assess the level of community services in the Pantex ROI. School enrollments are projected to increase from 39,720 students in 1995 to 46,360 students by 2040. The current student-to-teacher ratio is 16.3:1 and to maintain this level of service, the number of teachers in the ROI would need to increase from 2,438 in 1995 to 2,846 in 2040. No Action projections are presented in Appendix Tables L.1-40 and L.1-41.

The projected numbers of sworn police officers and firefighters serving ROI communities between 1995 and 2040 are shown in Tables L.1-42 and L.1-43, respectively. Under No Action, the number of sworn police officers is projected to increase from 463 in 1995 to 542 in 2040 if the current service level of 2.3 officers per 1,000 persons is maintained. The number of firefighters in the ROI would need to increase from 412 in 1995 to 481 in 2040 to maintain the current level of service of 2.3 firefighters per 1,000 persons.

Hospital occupancy rates are based on current capacity. Hospital occupancy rates and the estimated number of practicing physicians serving the ROI population during the period 1995 to 2040, are presented in Tables L.1-44 and L.1-45, respectively. Hospital occupancy rates in the ROI are projected to increase from 56 percent in 1995 to 65 percent in 2040. If the current physician-to-population ratio of 2.0 physicians per 1,000 persons is maintained, the total number of physicians is projected to increase from 408 in 1995 to 476 in 2040.

Local Transportation. The worker population at Pantex would not increase. Therefore, any increases in traffic would be due to the projected growth in the area unrelated to DOE activities. [Text deleted.]

Upgrade Alternative

Preferred Alternative: Upgrade With Rocky Flats Environmental Technology Site Plutonium Pits Subalternative

Modify Existing Zone 12 South Facilities for Continued Plutonium Storage

The upgrade to continue storing the Pu already located at Pantex and RFETS pits would require 19 workers during peak construction and 90 workers during full operation. There would be sufficient available labor in the REA to fill both direct and indirect jobs created by construction. Therefore, no workers would in-migrate to the region and no change to the region's population would result beyond No Action projections. Some specialized workers would in-migrate during operation.

Regional Economy Characteristics. During peak construction of the upgraded facility, a total of 34 jobs (19 direct and 15 indirect) would be generated. Unemployment in the REA would remain at 4.8 percent, as projected under No Action, and the per capita income would increase by less than 1 percent (Socio 1996a).

Operation of the facility would generate a total of 406 jobs (90 direct and 316 indirect). Total employment in the REA would increase less than 1 percent over No Action, and the unemployment rate would fall to 4.7 percent. Per capita income would increase less than 1 percent (Socio 1996a).

Population and Housing. Projections indicate that there would be sufficient available labor to fill all of the direct and indirect jobs generated by the construction of the facility. However, some qualified workers would in-migrate to the region during the operation of the facility. Any population increase in the region would be much less than 1 percent, and projected housing vacancies would be sufficient to accommodate the slight population growth.

Community Services. No in-migration would occur during construction and the size of the population change during operations would be too small to affect the demand for most community services. Therefore, demand for community services would be the same as for No Action, although one additional physician would be required to maintain the physician to population ratio of 2.0 physicians per 1,000 persons for the ROI.

Local Transportation. During peak construction of the facility, workers would generate 36 vehicle trips per day, and during full operations, workers would generate 173 vehicle trips per day. These increases would not affect the level of service on the local road segments analyzed (Socio 1996a).

Upgrade Without Rocky Flats Environmental Technology Site Plutonium or Los Alamos National Laboratory Plutonium Subalternative

Modify Existing Zone 12 South Facilities for Continued Plutonium Storage

The Upgrade Without RFETS Pu or LANL Pu Subalternative is similar to the Upgrade With RFETS Pu Pits Subalternative because the modified facilities in Zone 12 South would be designed with adequate capacity to store all of the RFETS Pu pits. No additional resources would be required and therefore the impacts would be the same.

Upgrade With All or Some Rocky Flats Environmental Technology Site Plutonium and Los Alamos National Laboratory Plutonium Subalternative

Modify Existing Zone 12 South Facilities for Continued Plutonium Storage

Construction and operation employment requirements for this facility would be greater than for the Upgrade With RFETS Pu Pits Subalternative, but smaller than for the Consolidation Alternative to Construct New and Modify Existing Zone 12 South Facilities. Therefore, the socioeconomic impacts would likely be greater than previously discussed for the Upgrade With RFETS Pu Pits Subalternative, but smaller than discussed for the Consolidation through upgrade.

[Text deleted.]

Consolidation Alternative

Construct New and Modify Existing Zone 12 South Facilities

To upgrade the facility for consolidated Pu storage, 1,142 workers would be needed during peak construction and 509 direct workers would be needed for operations. Some of the direct jobs during both phases would be

filled by in-migrating workers. The effects of this in-migration on the region's economy, employment, population, housing, community services, and local transportation are discussed below.

Regional Economy Characteristics. During peak construction of the facility, the REA's total employment would increase from the projected No Action employment by almost 1 percent. A total of 2,063 jobs (1,142 direct and 921 indirect) would be generated by constructing the facility. Unemployment would decrease from 4.8 percent to 4.2 percent. Per capita income would increase by less than 1 percent (Socio 1996a).

Operation of the facility would generate 2,295 jobs (509 direct and 1,786 indirect). Total employment in the region during full operation would increase approximately 1 percent over the No Action projection, and unemployment would decrease to 4.0 percent. Per capita income would increase by less than 1 percent (Socio 1996a).

Population and Housing. Some qualified workers would in-migrate to the ROI during both the construction and operational phases. However, any population change in the region would be less than 1 percent and projected housing vacancies would be sufficient to accommodate the slight population growth (Socio 1996a).

Community Services. An increase in total ROI school enrollment of 251 during construction and 153 during operation of the facility would require 16 teachers above the No Action level during construction and 9 additional teachers during full operations in order to maintain the No Action level of service (Socio 1996a). These increases represent the sum of changes across all the school districts in the ROI, and no single school district would be significantly affected.

The police force in the ROI would need to expand by two officers during both construction and operation in order to maintain the No Action level of service. The additional population resulting from construction would require three firefighters over No Action, while additional population during operations would require only two additional firefighters (Socio 1996a).

Hospital occupancy rates would increase slightly over No Action projections, but available hospital capacity would be able to absorb this increase. Population increases would require three additional physicians during construction and two additional physicians during both construction and operations to maintain the No Action level of service (Socio 1996a).

Local Transportation. During peak construction, workers would generate 2,193 vehicle trips per day. This increase would cause a drop in level of service on two local road segments. Farm-to-Market Road 683 from U.S. 60 to Farm-to-Market Road 293, a rural two lane highway, would experience a drop in level of service from A to B. I-27 from Local Route 335 at Amarillo to I-40 at Amarillo would experience a drop in level of service from D to E.

During operations, workers would generate 977 vehicle trips per day. This increase would not affect the level of service on the local road segments analyzed (Socio 1996a).

Construct New Plutonium Storage Facility

The new consolidated Pu storage facility would generate over 2,000 jobs (direct and indirect) during peak construction and over 2,100 jobs during operation. Many of the direct jobs during both construction and operation of the new facility would be expected to be filled by in-migrating workers. The effects of this in-migration on the region's economy, employment, population, housing, community services, and local transportation are discussed below.

Regional Economy Characteristics. A total of 2,067 jobs (1,144 direct and 923 indirect) would be generated during construction. Total employment in the REA would increase by almost 1 percent over the No Action projection as a result of construction activities. Unemployment would decrease from the No Action projection of

4.8 percent to 4.2 percent. Per capita income would increase by much less than 1 percent over the No Action projection.

Operation of the consolidated storage facility at Pantex would generate 2,133 jobs (471 direct and 1,660 indirect) during full operation, increasing total employment in the REA by approximately 1 percent over the No Action projection. Unemployment would decrease to 4.1 percent. Per capita income would increase by less than 1 percent over the No Action projection (Socio 1996a).

Population and Housing. Project workers and their families would be expected to in-migrate to the ROI to fill direct jobs created by construction and operation of the storage facility. However, the ROI population is expected to increase by less than 1 percent over No Action projections during both construction and operation, and projected housing vacancies would accommodate the increased demand (Socio 1996a).

Community Services. The in-migration of approximately 1,384 persons during construction and 762 persons during full operation of the facility would slightly increase the demand for community services. Although school enrollments would increase by less than 1 percent over the projected No Action levels during both construction and full operation, additional teachers would be needed to maintain the No Action level of service. The total number of teachers in the ROI would need to increase by 16 during construction and 8 during operation in order to maintain the No Action level of service (Socio 1996a).

The number of sworn police officers would need to increase by two over No Action projections during construction and by one during operation in order to maintain the No Action service level. Additionally, to maintain the No Action service level of fire protection, the number of firefighters would need to increase by three during construction and one during operations (Socio 1996a).

Hospital occupancy rates during construction and full operation would be slightly higher than the projected No Action rates, but existing capacity would be able to absorb the increase. The number of physicians in the ROI would need to increase by two during construction and by one during full operation in order to maintain the No Action service level (Socio 1996a).

Local Transportation. During peak construction, workers would generate 2,196 vehicle trips per day. This increase would cause a drop in level of service on two local road segments. Farm-to-Market Road 683 from U.S. 60 to Farm-to-Market Road 293, a rural two lane highway, would experience a drop in level of service from A to B. I-27 from Local Route 335 at Amarillo to I-40 at Amarillo would experience a drop in level of service from D to E. Operation workers would generate 908 vehicle trips per day and this increase would not affect the level of service on the local road segments analyzed (Socio 1996a).

Collocation Alternative

Construct New Plutonium and Highly Enriched Uranium Storage Facilities

Construction of new storage facilities would be required in order to store Pu and HEU at Pantex. Projections indicate that workers would in-migrate to fill some of the direct jobs generated during both the construction and operation phases at Pantex. However, there would be sufficient labor available in the REA to fill the indirect jobs created during both periods. The effects on the region's economy, population, housing, community services, and local transportation are discussed below.

Regional Economy Characteristics. Construction of the consolidated Pu and HEU storage facilities would generate a total of 2,125 jobs (1,176 direct and 949 indirect) in the REA during peak construction at Pantex. Projections indicate that the available labor force would fill all the indirect jobs created, but approximately 558 in-migrant workers would be needed to fill the direct labor requirements. Total employment in the REA would increase 1.0 percent over No Action projections, and unemployment would decrease from 4.8 percent to 4.2 percent. Per capita income would increase less than 1 percent (Socio 1996a).

Operation of the proposed storage facilities would generate a total of 2,710 jobs (601 direct and 2,109 indirect) in the REA. While some specialized direct jobs would be filled by in-migrating workers, all of the indirect positions would be filled by available labor in the region. Total employment in the REA would increase 1.2 percent over the No Action projection, and the REA unemployment rate would decrease to 3.9 percent. Per capita income would increase by less than 1 percent (Socio 1996a).

Population and Housing. Approximately 1,468 and 1,070 persons are projected to in-migrate to the region during the construction and operation phases of the proposed storage facilities, respectively (Socio 1996a). Projected housing vacancies would be sufficient to accommodate the increase in demand for housing units.

Community Services. The in-migration of population during both the construction and operation phases of the proposed alternative would slightly increase the demand for community services. ROI school enrollments are projected to increase by 269 and 196 students during peak construction and at full operation, respectively. In order to maintain the No Action level of service, the number of teachers would need to increase by 17 during construction and 11 during full operation of the proposed facility (Socio 1996a).

During both peak construction and full operation, the number of sworn police officers would need to increase by two in order to maintain the No Action level of service. [Text deleted.] In order to maintain the No Action service level of 2.0 firefighters per 1,000 persons, the number of firefighters would need to increase by four during peak construction and by two during full operation (Socio 1996a).

Projected hospital occupancy rates, during peak construction and full operation, would be slightly higher than the No Action projections, but existing capacity would be able to accommodate the increase. The number of physicians in the ROI would need to increase by two during both peak construction and full operation in order to maintain the No Action service level (Socio 1996a).

Local Transportation. During peak construction, workers would generate 2,258 vehicle trips per day. This increase would cause a drop in level of service on two local road segments. Farm-to-Market Road 683 from U.S. 60 to Farm-to-Market Road 293, a rural two lane highway, would experience a drop in level of service from A to B. I-27 from Local Route 335 at Amarillo to I-40 at Amarillo would experience a drop in level of service from D to E. Operation employees would generate 1,154 vehicle trips per day. This increase would not affect the level of service on the local road segments analyzed (Socio 1996a).

Subalternative Not Including Strategic Reserve and Weapons Research and Development Materials

Not including the strategic reserve and weapons R&D materials in the storage options would slightly reduce the number of employees needed during operations. Fewer workers would in-migrate, and the increase in demand for housing and community services would be smaller. A smaller workforce would still benefit the regional economy, but on a smaller scale than if the larger facility was constructed for the No Action Alternative, the Upgrade Alternative, the Consolidation Alternative, and the Collocation Alternative. [Text deleted.]

Phaseout

Phaseout of existing Pu storage facilities at Pantex would result in a loss of five operational employees. Some of these positions would likely be transferred to other onsite activities, reducing the impact of a storage facility phaseout. At maximum, phaseout would result in a total loss of 28 direct and indirect jobs within the region, but decreases to regional employment and income would be imperceptible. In the longer term, some displaced workers would be expected to leave the region to seek other employment opportunities. However, any resulting decreases in population would be negligible.

Phaseout of the existing Pu storage facilities at Pantex would slightly reduce the number of vehicle trips per day generated by site workers. There would be no significant traffic impact to the local road network due to this alternative.

4.2.4.9 Public and Occupational Health and Safety

The assessments of potential radiological and chemical impacts associated with the storage alternatives at Pantex are presented in this section. Summaries of radiological impacts from normal operations are presented in Tables 4.2.4.9–1 and 4.2.4.9–2 for the public and workers, respectively. Impacts from the hazardous chemicals are presented in Table 4.2.4.9–3. Summaries of impacts associated with postulated accidents are given in Tables 4.2.4.9–4 through 4.2.4.9–8. Detailed results are presented in Appendix M.

Aircraft Crash. Pantex is located approximately 13.6 km (8.5 mi) from the northeast-southwest runway at Amarillo International Airport. Potential accident scenarios in which an aircraft crashes into one or more facilities at Pantex have been developed for the Pantex EIS. A discussion of aircraft crash accident for this PEIS is contained in Appendix R.

No Action Alternative

This section describes the radiological and hazardous chemical releases and their associated impacts resulting from normal operations involved with the Pantex site-wide missions, including storage of Pu. The impacts would be within applicable regulatory limits. For facility accidents, the risks and consequences are described in site safety documentation.

Normal Operation. The current mission at Pantex, where Pu is in interim storage, is described in Section 3.5. The site has identified those facilities that will continue to operate under the No Action Alternative, including Pu storage facilities and others, if any, that will become operational by 2005. Based on that information, the radiological and chemical releases to the environment in 2005 and beyond (future operation) were developed and used in the impact assessments. The resulting doses and potential health effects to the public and workers at Pantex are described below.

Radiological Impacts. The calculated annual dose to the average and maximally exposed members of the public from total site operation; the associated fatal cancer risks to these individuals from 50 years of operation; the dose to the population within 80 km (50 mi) from total site operation in the year 2030; and the projected number of fatal cancers in this population from 50 years of operation are presented in Table 4.2.4.9–1 under this alternative at Pantex. The annual dose of 6.1×10^{-5} mrem to the MEI is within the radiological limits specified in NESHAPS (40 CFR 61, Subpart H) and DOE Order 5400.5. From 50 years of operation, the corresponding risk of fatal cancer to this individual would be 1.5×10^{-9} . The annual dose of 2.8×10^{-4} person-rem to the population would be within the limit in proposed 10 CFR 834. The corresponding number of fatal cancers in this population from 50 years of operation would be 7.0×10^{-6} . To put operational dose impacts into perspective, comparisons with doses from natural background radiation are included in the table.

Under the No Action Alternative, as shown in Table 4.2.4.9–2, the annual average dose to a non-involved (No Action) site worker and the annual dose to the non-involved (No Action) total site workforce would be 10 mrem and 14 person-rem, respectively. The associated risk of fatal cancer to the average worker from 50 years of total site operations would be 2.0×10^{-4} , and the projected number of fatal cancers among all workers from 50 years of total site operations would be 0.28. Dose to individual workers would be kept low by instituting badged monitoring and ALARA programs and also workers rotations. As a result of the implementation of these mitigation measures, the actual number of fatal cancers calculated would be lower for the operation of this facility.

Hazardous Chemical Impacts. Hazardous chemical impacts to the public resulting from the normal operation under this alternative at Pantex are presented in Table 4.2.4.9–3. The hazardous chemical impacts from current site operations were used to estimate the baseline site impacts for the various storage alternatives. The noncancer health effects expected and the risk of cancer due to the total chemical exposures were estimated for each site. Since the major releases due to normal operations at Pantex are expected to make up nearly all of the exposures

Table 4.2.4.9-2. Potential Radiological Impacts to Workers During Normal Operation at Pantex Plant—Storage Alternatives

	Upgrade ^a	Upgrade ^a	Upgrade ^a	Consolidation ^a	Collocation ^a	
Receptor	With RFETS Pits	Without RFETS or LANL Pu	With RFETS and LANL Pu	New and Modify Zone 12 South	New Facility	New Facility
Involved Workforce^b						
Average worker dose (mrem/yr) ^c	116	116	116	254	258	264
50-year risk of fatal cancer	2.3x10 ⁻³	2.3x10 ⁻³	2.3x10 ⁻³	5.1x10 ⁻³	5.2x10 ⁻³	5.3x10 ⁻³
Total dose (person-rem/yr)	3	3	6	31	24	25
50-year fatal cancers	0.06	0.06	0.12	0.62	0.48	0.50
Noninvolved Workforce^d						
Average worker dose (mrem/yr) ^c	24	24	24	24	24	24
50-year risk of fatal cancer	4.8x10 ⁻⁴	4.8x10 ⁻⁴	4.8x10 ⁻⁴	4.8x10 ⁻⁴	4.8x10 ⁻⁴	4.8x10 ⁻⁴
Total dose (person-rem/yr)	34	34	34	34	34	34
50-year fatal cancers	0.68	0.68	0.68	0.68	0.68	0.68
Total Site Workforce^e						
Dose (person-rem/yr)	37	37	40	65	58	59
50-year fatal cancers	0.74	0.74	0.80	0.90	0.76	0.78

^a Under the Upgrade Alternative (either without RFETS or LANL Pu or with RFETS pits), 25 in-plant workers badged with dosimeters to monitor radiation exposure would be required to operate the storage facility, with an estimated additional 25 badged in-plant workers needed if Pu (pit and non-pit material) is transferred from RFETS and LANL. The impacts given in the Upgrade Alternative (with RFETS and LANL Pu) include those associated with these additional workers. The number of involved badged workers for the two Consolidation Alternatives would be 123 and 92; for the Collocation Alternative the number of badged workers would be 95.

^b The involved worker is a worker associated with operations of the proposed action. The maximum dose to an involved worker would be kept below 500 mrem per year. [Text deleted.] An effective ALARA program will ensure that the exposure will be reduced to that level which is as low as reasonably achievable.

^c The radiological limit for an individual worker is 5,000 mrem/year (10 CFR 835). However, DOE has also established an administrative control level of 2,000 mrem per year (DOE 1992t); the site must make reasonable attempts to maintain worker doses below this level.

^d The noninvolved worker is a worker onsite but not associated with operations of the proposed action. The projected number of noninvolved badged workers in 2005 is 1,400. The noninvolved workforce is equivalent to the No Action workforce.

^e The impact to the total site workforce is the summation of the in-plant worker impact and the noninvolved worker impact.

[Text deleted.]

Source: PX 1996e:2; PX DOE 1996a; and Section M.2.

to onsite workers and to the public in adjacent communities, contributions to the hazardous chemical concentrations from all other sources (for example, industrial operations) are considered negligible for purposes of risk calculations.

The HI to the MEI of the public at Pantex resulting from normal operation under the No Action Alternative is 5.7×10^{-3} , and the cancer risk is 1.1×10^{-8} . The HI to the onsite worker is 6.1×10^{-3} , and the cancer risk is 4.5×10^{-7} .

Facility Accidents. Under the No Action Alternative, Pu would continue to be stored at Pantex in existing facilities. These facilities currently operate in accordance with DOE safety orders which ensure that the risk to the public of prompt fatalities due to accidents or cancer fatalities due to operations will be minimized. The safety to workers and the public from accidents at existing facilities is also controlled by Technical Safety Requirements specified in detail in SARs or a Basis for Interim Operations document prepared and maintained specifically for a facility or process within a facility. Under these controls, any change in approved operations or to facilities would cause a halt in operations until it can be established that worker and public safety has not been compromised.

Table 4.2.4.9–3. Potential Hazardous Chemical Impacts to the Public and Workers During Normal Operation at Pantex Plant—No Action and Storage Alternatives

Receptor	No Action	Upgrade ^a		Consolidation		Collocation	
	Total Site ^b	Facility ^c	Total Site ^b	Facility ^c	Total Site ^b	Facility ^c	Total Site ^b
Maximally Exposed Individual (Public)							
Hazard index ^d	5.7x10 ⁻³	0	5.7x10 ⁻³	1.4x10 ⁻⁴	5.8x10 ⁻³	2.0x10 ⁻⁴	5.9x10 ⁻³
Cancer risk ^e	1.1x10 ⁻⁸	0	1.1x10 ⁻⁸	1.5x10 ⁻⁷	1.6x10 ⁻⁷	1.5x10 ⁻⁷	1.6x10 ⁻⁷
Worker Onsite							
Hazard index ^f	6.1x10 ⁻³	0	6.1x10 ⁻³	7.0x10 ⁻⁴	6.8x10 ⁻³	9.3x10 ⁻⁴	7.1x10 ⁻³
Cancer risk ^g	4.5x10 ⁻⁷	0	4.5x10 ⁻⁷	6.2x10 ⁻⁶	6.7x10 ⁻⁶	6.2x10 ⁻⁶	6.7x10 ⁻⁶

^a Chemical impacts are the same for all three upgrade subalternatives.

^b Total=Sum of the No Action plus the contributions of the above facility.

^c Contribution from the above activity only (that is, the amount of increase over the existing No Action level at the site).

^d Hazard index for MEI=Sum of the individual Hazard Quotients (noncancer health effects) for MEI.

^e Cancer risk for MEI=(Emissions for 8-hour) x (0.286 [converts concentrations to doses]) x (slope factor [SF]).

^f Hazard index for workers=Sum of individual Hazard Quotients (noncancer health effects) for workers.

^g Cancer risk for workers=(Emissions for 8-hour) x (0.286 [converts concentrations to doses]) x (0.237 [fraction of year exposed]) x (0.571 [fraction of lifetime working]) x (SF).

Note: Where there are no known carcinogens among the hazardous chemicals emitted, there are no slope factors, therefore the calculated cancer risk value is 0.

Source: Section M.3; Tables M.3.4–14 through M.3.4–17.

Upgrade Alternative

Preferred Alternative: Upgrade With Rocky Flats Environmental Technology Site Plutonium Pits Subalternative

Modify Existing Zone 12 South Facilities for Continued Plutonium Storage

This section describes the radiological and hazardous chemical releases and their associated impacts resulting from either normal operation or accidents involved with the modified existing Pu storage facilities under the Upgrade Alternative at Pantex. The section describes the impacts from normal facility operations at Pantex, then describes impacts from facility accidents.

During normal operation at Pantex, the operation of the Pu storage facilities under this alternative would result in impacts that are within applicable regulatory limits. Storage of RFETS pits would occur in Zone 4 until Zone 12 facilities are available for the Preferred Alternative. The radiological impacts for intersite transportation between Zone 4 and Zone 12, the repackaging from FL(B) into AL-R8 containers, and the storage in Zone 4 of pits from RFETS are described in Appendix Q.

[Text deleted.]

Normal Operation. There would be no radiological releases during the modification of existing storage facilities at Pantex. Construction worker exposures to materials potentially contaminated with radioactivity (for example, from construction activities involved with existing contaminated soil) would be limited to assure that doses are maintained ALARA. Toward this end, construction workers would be monitored as appropriate. Limited hazardous chemical releases are anticipated as a result of the construction activities. However, concentrations would be within the regulated exposure limits. During normal operation, there would be both radiological and hazardous chemical releases to the environment and also direct exposures. The resulting doses and potential health effects to the public and workers at Pantex are described below.

Radiological Impacts. The dose to the public would be reduced slightly from the No Action Alternative for the Upgrade With RFETS Pu Pits Subalternative, as shown in Table 4.2.4.9–1. The number of pits at Pantex to be 4–220

stored in upgraded facilities in Zone 12 South would be slightly increased by the addition of RFETS pits. However, before the material would be placed in facilities in Zone 12, pits would be repackaged from AL-R8 containers into AT-400A containers. The AT-400A has both an inner container (which is welded and prevents the release of any radioactive materials) and an outer container (which also prevents the release of radioactive materials and provides additional shielding material). The upgraded storage facilities in Zone 12 would have improved safety and design features over those in Zone 4, including filters to reduce the possibility of airborne releases to the atmosphere. Therefore, the overall effect of moving Pantex and RFETS pits into upgraded Zone 12 storage facilities would be lower potential releases of radioactive materials to the public.

Doses to onsite workers from normal operations are given in Table 4.2.4.9–2. Included in the table are involved workers directly associated with the storage facilities, workers who are not involved with these facilities, and the entire workforce at Pantex. All doses would fall within regulatory limits and administrative control levels. The total dose to the involved workforce would be 3 person-rem/year, and for 50 years of operation the fatal cancers would be 0.06.

Hazardous Chemical Impacts. Hazardous chemical impacts to the public and to the onsite worker resulting from the normal operations of the modified facilities under the Upgrade Alternative at Pantex are presented in Table 4.2.4.9–3. The impacts from all site operations, including the storage facilities, are included in this table. Total site impacts, which include the No Action impact plus the facilities, are provided. All analyses to support the values presented in this table are provided in Section M.3.

The HI to the MEI of the public would be zero (because no hazardous substances would be released), and the cancer risk would be zero (because no carcinogens would be released) as a result of operation of the storage facilities under the Upgrade Alternative in the year 2030. The HI and cancer risk from hazardous chemicals would remain constant over 50 years of operation, because exposures would be expected to remain the same. The total site operation, including the storage facilities, would result in an HI of 5.7×10^{-3} and a cancer risk of 1.1×10^{-8} for the MEI in the year 2030. This would be expected to remain constant as a result of 50 years of operation.

The HI to the onsite worker would be zero (because no hazardous substances would be released), and the cancer risk is zero (because no carcinogens would be released from the hazardous chemicals used) as a result of operation of the storage facilities in the year 2030. The HI and cancer risk would remain constant over 50 years of operation, because exposures are expected to remain the same. The total site operation, including the storage facilities, would result in an HI of 6.1×10^{-3} and a cancer risk of 4.5×10^{-7} for the onsite worker in the year 2030. This would be expected to remain constant as a result of 50 years of operation.

Facility Accidents. A set of potential accidents have been postulated for the Upgrade With RFETS Pu Pits Subalternative facility for which there may be releases of Pu that may impact onsite workers and the offsite population. The accident consequences and risks to a worker located 1,000 m (3,280 ft) from the accident release point, the maximum offsite individual located at the site boundary, and the population located within 80 km (50 mi) of the accident release point are summarized in Table 4.2.4.9–4. For the set of accidents analyzed, the maximum number of cancer fatalities in the population within 80 km (50 mi) would be 0.26 at Pantex for the beyond design basis earthquake accident scenario with a probability of 1.0×10^{-7} per year. The corresponding 50-year facility lifetime risk from the same accident scenario for the population, maximum offsite individual, and worker at 1,000 m (3,280 ft), would be 1.3×10^{-6} , 8.4×10^{-9} , and 2.3×10^{-8} , respectively. The maximum population 50-year facility lifetime risk would be 8.8×10^{-4} (that is, one fatality in about 57,000 years) at Pantex for the PCV penetration accident scenario with a probability of 0.04 per year. The corresponding maximum offsite individual and worker 50-year facility lifetime risks would be 5.8×10^{-6} and 1.4×10^{-5} , respectively. Section M.5 presents additional facility accident data and summary descriptions of the accident scenario identified in Table 4.2.4.9–4.

**Table 4.2.4.9–4. Upgrade With Rocky Flats Environmental Technology Site Plutonium Pits
Subalternative—Accident Impacts at Pantex Plant**

Accident Description	Worker at 1,000 m		Maximum Offsite Individual		Population to 80 km		Accident Frequency (per yr)
	Risk of Cancer Fatality (per 50 yr) ^a	Probability of Cancer Fatality ^b	Risk of Cancer Fatality (per 50 yr) ^a	Probability of Cancer Fatality ^b	Risk of Cancer Fatalities (per 50 yr) ^a	Number of Cancer Fatalities ^c	
PCV puncture by forklift	5.3×10^{-8}	1.8×10^{-6}	2.1×10^{-8}	7.1×10^{-7}	3.2×10^{-6}	1.1×10^{-4}	6.0×10^{-4}
PCV breach by firearms discharge	3.1×10^{-9}	1.8×10^{-7}	1.2×10^{-9}	7.1×10^{-8}	1.9×10^{-7}	1.1×10^{-5}	3.5×10^{-4}
PCV penetration by corrosion	1.4×10^{-5}	7.2×10^{-6}	5.8×10^{-6}	2.9×10^{-6}	8.8×10^{-4}	4.4×10^{-4}	0.04
Vault fire	1.2×10^{-8}	2.4×10^{-3}	4.7×10^{-9}	9.4×10^{-4}	7.2×10^{-7}	0.14	1.0×10^{-7}
Truck bay fire	1.2×10^{-9}	2.5×10^{-4}	4.9×10^{-10}	1.0×10^{-4}	7.6×10^{-8}	0.015	1.0×10^{-7}
Spontaneous combustion	1.2×10^{-11}	3.5×10^{-7}	4.9×10^{-12}	1.4×10^{-7}	7.6×10^{-10}	2.2×10^{-5}	7.0×10^{-7}
Explosion in the vault	1.8×10^{-9}	3.6×10^{-4}	7.2×10^{-10}	1.4×10^{-4}	1.1×10^{-7}	0.023	1.0×10^{-7}
Explosion outside of vault	1.3×10^{-11}	2.7×10^{-6}	5.3×10^{-12}	1.1×10^{-6}	8.2×10^{-10}	1.6×10^{-4}	1.0×10^{-7}
Nuclear criticality	9.7×10^{-12}	1.9×10^{-6}	4.6×10^{-12}	9.3×10^{-7}	1.2×10^{-10}	2.3×10^{-5}	1.0×10^{-7}
Beyond evaluation basis earthquake	2.3×10^{-8}	4.7×10^{-3}	8.4×10^{-9}	1.7×10^{-3}	1.3×10^{-6}	0.26	1.0×10^{-7}
Expected risk ^d	1.4×10^{-5}	–	5.8×10^{-6}	–	8.8×10^{-4}	–	–

^a The risk values are calculated by multiplying the probability of cancer fatality (for the worker at 1,000 m or the maximum offsite individual or the number of cancer fatalities (for the population to 80 km) by the accident frequency and the number of years of operation.

^b Increased likelihood (or probability) of cancer fatality to a hypothetical individual (a single onsite worker at a distance of 1,000 m or the site boundary, whichever is smaller or to a hypothetical individual in the offsite population located at the site boundary) if exposed to the indicated dose. The value assumes the accident has occurred.

^c Estimated number of cancer fatalities in the entire offsite population out to a distance of 80 km if exposed to the indicated dose. The value assumes the accident has occurred.

^d Expected risk is the sum of the risks over the 50-year lifetime of the facility.

Note: All values are mean values.

Source: Calculated using the impacts in Table 4.2.4.9–7 with adjustments to reflect smaller quantities of Pu for upgraded storage.

Involved workers, those that would work in the facilities associated with the proposed action, may be subject to injury and, in some cases, fatality as a result of potential accidents. Because the facilities will be modified, design information necessary to support a reasonable estimate of the accident impacts to the involved workers is not yet available. Such information would specify the locations of workstations, number of workers, personnel protective features, engineered safety features, and other design details that affect the extent of worker exposures to accidents. Certain accidents such as fires, explosions and criticality could cause fatalities to workers close to the accident. Before modification of an existing facility, DOE Orders require detailed safety analyses to assure that facility designs and operating procedures limit the number of workers in hazardous areas and minimize risk of injury or fatality in the event of an accident.

Upgrade Without Rocky Flats Environmental Technology Site Plutonium or Los Alamos National Laboratory Plutonium Subalternative

Modify Existing Zone 12 South Facilities for Continued Plutonium Storage

During normal operation, there would be a slight reduction in radiological and hazardous chemical impacts from the Upgrade With RFETS Pits Subalternative if no RFETS or LANL Pu is moved to Pantex. The radiation impacts during normal operations to the public and workers are shown Tables 4.2.4.9–1 and 4.2.4.9–2, respectively. The doses to the public and workers for upgrade without RFETS Pu or LANL Pu is shown together

with the doses to the public and workers for upgrade with RFETS pits because this reduction in dose to the public and workers would not be measurable above background. The chemical impacts to the public and workers are shown in Table 4.2.4.9–3 and would not be detectable from the impacts for an upgrade facility with RFETS pits. For facility accidents, the impacts without RFETS Pu or LANL Pu would be slightly reduced from the impacts shown in Table 4.2.4.9–4 because of the smaller amount of Pu material. This reduction in potential impacts would not be detectable or measurable above background.

Involved workers, those that would work in the facilities associated with the proposed action, may be subject to injury and, in some cases, fatality as a result of potential accidents. Because the facilities will be modified, design information necessary to support a reasonable estimate of the accident impacts to the involved workers is not yet available. Such information would specify the locations of workstations, number of workers, personnel protective features, engineered safety features, and other design details that affect the extent of worker exposures to accidents. Certain accidents such as fires, explosions and criticality could cause fatalities to workers close to the accident. Before modification of an existing facility, DOE Orders require detailed safety analyses to assure that facility designs and operating procedures limit the number of workers in hazardous areas and minimize risk of injury or fatality in the event of an accident.

Upgrade With All or Some Rocky Flats Environmental Technology Site Plutonium and Los Alamos National Laboratory Plutonium Subalternative

Modify Existing Zone 12 South Facilities for Continued Plutonium Storage

During normal operation, there would be a slight increase in radiological and hazardous chemical impacts from the Upgrade With RFETS Pits Subalternative if all of the RFETS and LANL Pu is moved to Pantex. The radiation impacts during normal operations to the public and workers are shown Tables 4.2.4.9–1 and 4.2.4.9–2, respectively. The doses to the public for upgrade with all the RFETS Pu and LANL Pu are shown together with the doses to the public and workers for upgrade with RFETS pits because the difference in the dose to the public would not be measurable above background. The doses to the workers with all the RFETS Pu and LANL Pu would be increased to 6 person-rem/year. The increase would be because the non-pit material would require additional handling not currently performed at Pantex. The chemical impacts to the public and workers are shown in Table 4.2.4.9–3 and would not be detectable from the impacts for an upgrade facility with RFETS pits. For facility accidents, the impacts with all RFETS Pu and LANL Pu would be increased above the impacts shown in Tables 4.2.4.9–5 and 4.2.4.9–6 because the non-pit material would require additional handling and operations not currently performed at Pantex.

Involved workers, those that would work in the facilities associated with the proposed action, may be subject to injury and, in some cases, fatality as a result of potential accidents. Because the facilities will be modified, design information necessary to support a reasonable estimate of the accident impacts to the involved workers is not yet available. Such information would specify the locations of workstations, number of workers, personnel protective features, engineered safety features, and other design details that affect the extent of worker exposures to accidents. Certain accidents such as fires, explosions and criticality could cause fatalities to workers close to the accident. Before modification of an existing facility, DOE Orders require detailed safety analyses to assure that facility designs and operating procedures limit the number of workers in hazardous areas and minimize risk of injury or fatality in the event of an accident.

[Text deleted.]

Consolidation Alternative

This section includes a description of radiological and hazardous chemical releases and their associated impacts resulting from either normal operation or accidents involved with new or modified consolidated Pu storage

facilities at Pantex. Normal operation under either of the two consolidated storage options would result in impacts that are within applicable regulatory limits.

[Text deleted.]

Construct New and Modify Existing Zone 12 South Facilities

Normal Operation. There would be no radiological releases from constructing a new storage facility or from modifying existing storage facilities to store the consolidated Pu. Construction worker exposures to material potentially contaminated with radioactivity (for example, from construction activities involved with existing contaminated soil) would be limited to assure that doses are maintained ALARA. Toward this end, construction workers would be monitored as appropriate. Limited hazardous chemical releases are anticipated as a result of construction activities. However, concentrations would be within the regulated exposure limits. During normal operation, there would be both radiological and hazardous chemical releases to the environment and also direct in-plant exposures. The resulting doses and potential health effects to the public and workers at Pantex are described below for consolidated Pu storage in the modified storage facility.

Radiological Impacts. Radiological impacts to the public resulting from the normal operation of the new and modified Pu storage facilities at Pantex are presented in Table 4.2.4.9–1. The impacts from all site operations, including the storage facilities, are also given in the table. To put operational doses into perspective, comparisons with doses from natural background radiation are included in the table.

The dose to the MEI from annual operations of the new and modified storage facilities would be 9.5×10^{-6} mrem. From 50 years of operation, the corresponding risk of fatal cancer to this individual would be 2.4×10^{-10} . The impacts to the average member of the public would be less. As a result of operations in the year 2030, the population dose would be 5.5×10^{-5} person-rem. The corresponding number of fatal cancers in this population from 50 years of operation would be 1.4×10^{-6} .

The dose to the MEI from annual total site operations is within the radiological limits specified in NESHAPS (40 CFR 61, Subpart H) and DOE Order 5400.5, and would be 6.5×10^{-5} mrem. From 50 years of operation, the corresponding risk of fatal cancer to this individual would be 1.6×10^{-9} . The impacts to the average member of the public would be less. This activity would be included in a program to ensure that doses to the public are ALARA. As a result of total site operation in the year 2030, the population dose would be within the limit in proposed 10 CFR 834 and would be 3.3×10^{-4} person-rem. The corresponding number of fatal cancers in this population from 50 years of operation would be 8.4×10^{-6} .

Doses to onsite workers from normal operations are given in Table 4.2.4.9–2. Included are involved workers directly associated with the new and modified storage facilities, workers who are not involved with these facilities, and the entire workforce at Pantex. All doses fall within regulatory limits and administrative control levels. The associated risks and numbers of fatal cancers among the different workers from 50 years of operation are included in the table. Doses to individual workers would be kept low by instituting badged monitoring and ALARA programs and also workers rotations. As a result of the implementation of these mitigation measures, the actual number of fatal cancers calculated would be lower for the operation of this facility.

Hazardous Chemical Impacts. Hazardous chemicals associated with constructing new and modifying existing facilities for the consolidation of Pu will be equal to, or less than, hazardous chemicals associated with operations under the Collocation Alternative for Pu storage. The resulting hazardous chemical impacts to the public and worker will be equal to, or less than, those appearing in Table 4.2.4.9–3 for the collocation of Pu.

Facility Accidents. A set of potential accidents have been postulated for the upgrade of existing and construction of new storage facilities at Pantex for which there may be releases of Pu that may impact onsite workers and the offsite population. The accident consequences and risks to a worker located 1,000 m (3,280 ft)

from the accident release point, the maximum offsite individual located at the site boundary, and the general population located within 80 km (50 mi) of the accident release point are summarized in Table 4.2.4.9–5 for the Surplus Materials Storage Building and in Table 4.2.4.9–6 for the Strategic Reserves Storage Building. For the set of accidents analyzed, the maximum number of cancer fatalities in the population within 80 km (50 mi) would be 0.29 at the Pantex Surplus Materials Storage Buildings for the vault fire accident scenario with a probability of 1×10^{-7} per year. The corresponding 50-year facility lifetime risk from the same accident scenario for the population, maximum offsite individual, and worker at 1,000 m (3,280 ft), would be 1.5×10^{-6} , 1.1×10^{-8} and 2.9×10^{-8} , respectively. The maximum population 50-year facility lifetime risk would be 1.8×10^{-3} (that is, one fatality in about 28,000 years) at the Pantex Surplus Material Storage Building for the PCV penetration by corrosion accident scenario with a probability of 0.064 per year. The corresponding maximum offsite individual and worker 50-year facility lifetime risks would be 1.3×10^{-5} and 3.2×10^{-5} , respectively. For the set of accidents analyzed, the maximum number of cancer fatalities in the population within 80 km (50 mi) would be 1.8 at the Pantex Strategic Reserves Storage Building for the vault fire accident with a probability of 1×10^{-7} per year. The corresponding 50-year facility lifetime risk from the same accident scenario for the population, maximum offsite individual, and worker at 1,000 m (3,280 ft), would be 9.0×10^{-6} , 7.6×10^{-8} and 2.2×10^{-7} , respectively. The maximum population 50-year facility lifetime risk would be 1.8×10^{-3} at the Pantex Strategic Reserves Storage Building for the PCV penetration by corrosion accident scenario with a probability of 0.064 per year. The corresponding maximum offsite individual and worker 50-year facility lifetime risks would be 1.3×10^{-5} and 3.2×10^{-5} , respectively. Section M.5 presents additional facility accident data and summary descriptions of the accident scenarios identified in Tables 4.2.4.9–5 and 4.2.4.9–6.

Involved workers, those that would work in the facilities associated with the proposed action, may be subject to injury and, in some cases, fatality as a result of potential accidents. The locations of workstations, number of workers, personnel protective features, engineered safety features, and other design details affect the extent of worker exposures to accidents. Certain accidents such as fires, explosions, and criticality could cause fatalities to workers close to the accident. Before construction of a new or modification of an existing facility, DOE Orders require detailed safety analyses to assure that facility designs and operating procedures limit the number of workers in hazardous areas and minimize risk of injury or fatality in the event of an accident.

Construct New Plutonium Storage Facility

Normal Operation. There would be no radiological releases during the construction of a new consolidated Pu storage facility at Pantex. Construction worker exposures to material potentially contaminated with radioactivity would be limited to assure that doses are maintained ALARA. Toward this end, construction workers would be monitored as appropriate. Limited hazardous chemical releases are anticipated as a result of construction activities. However, concentrations would be within the regulated exposure limits. During normal operation, there would be both radiological and hazardous chemical releases to the environment and also direct in-plant exposures. The resulting doses and potential health effects to the public and workers at Pantex are described below for consolidated Pu storage in the new storage facility.

Radiological Impacts. Radiological impacts to the public resulting from the normal operation of the new consolidated Pu storage facility are presented in Table 4.2.4.9–1. The impacts from all site operations, including the new consolidated storage facility, are also given in the table. To put operational doses into perspective, comparisons with doses from natural background radiation are included in the table.

The dose to the MEI from annual storage plant operation would be 9.5×10^{-6} mrem. From 50 years of operation, the corresponding risk of fatal cancer to this individual would be 2.4×10^{-10} . The impacts to the average member of the public would be less. As a result of storage plant operation in the year 2030, the population dose would be 5.2×10^{-5} person-rem. The corresponding number of fatal cancers in this population from 50 years of operation would be 1.3×10^{-6} .

The dose to the MEI from annual total site operations is within the radiological limits specified in NESHAPS (40 CFR 61, Subpart H) and DOE Order 5400.5 and would be 6.5×10^{-5} mrem. From 50 years of operation, the corresponding risk of fatal cancer to this individual would be 1.6×10^{-9} . The impacts to the average member of the public would be less. This activity would be included in a program to ensure that doses to the public are ALARA. As a result of total site operation in the year 2030, the population dose would be within the limit in proposed 10 CFR 834 and would be 3.3×10^{-4} person-rem. The corresponding number of fatal cancers in this population from 50 years of operation would be 8.3×10^{-6} .

Facility and total site doses to onsite workers from normal operations are given in Table 4.2.4.9–2. Included are involved workers directly associated with the new consolidated storage facility, workers who are not involved with the new storage facility, and the entire workforce at Pantex. All doses fall within regulatory limits and administrative control levels. The associated risks and numbers of fatal cancers among the different workers from 50 years of operation are included in the table. The associated risks and numbers of fatal cancers among the different workers from 50 years of operation are included in the table. Dose to individual workers would be kept low by instituting badged monitoring and ALARA programs and also workers rotations. As a result of the implementation of these mitigation measures, the actual number of fatal cancers calculated would be lower for the operation of this facility.

Hazardous Chemical Impacts. Hazardous chemical impacts to the public and to the onsite worker resulting from the normal operations of the new consolidated Pu storage facility at Pantex are presented in Table 4.2.4.9–3. The impacts from all site operations, including the consolidated storage facility, are included in this table. Total site impacts, which include the No Action impact plus the facility, are provided. All analyses to support the values presented in this table are provided in Section M.3.

The HI to the MEI of the public is 1.4×10^{-4} , and the cancer risk is 1.5×10^{-7} as a result of operation of the new consolidated Pu storage facility in the year 2030. The HI and cancer risk from hazardous chemicals would remain constant over 50 years of operation, because exposures would be expected to remain the same. The total site operation, including the upgrade facility, would result in an HI of 5.8×10^{-3} and a cancer risk of 1.6×10^{-7} for the MEI in the year 2030. This would be expected to remain constant as a result of 50 years of operation.

The HI to the onsite worker would be 7.0×10^{-4} , and the cancer risk is 6.2×10^{-6} as a result of operation of the new consolidated Pu storage facility in the year 2030. The HI and cancer risk from hazardous chemicals would remain constant over 50 years of operation, because exposures would be expected to remain the same. The total site operation, including the new facility, would result in an HI of 6.8×10^{-3} and a cancer risk of 6.7×10^{-6} for the onsite worker in the year 2030. This would be expected to remain constant as a result of 50 years of operation.

Facility Accidents. A set of potential accidents have been postulated for a new consolidated storage facility for which there may be releases of Pu that may impact onsite workers and the offsite population. The accident consequences and risks to a worker located 1,000 m (3,280 ft) from the accident release point, the maximum offsite individual located at the site boundary, and the population located within 80 km (50 mi) of the accident release point are summarized in Table 4.2.4.9–7. For the set of accidents analyzed, the maximum number of cancer fatalities in the population within 80 km (50 mi) would be 0.41 at Pantex for the beyond design basis earthquake accident scenario with a probability of 1.0×10^{-7} per year. The corresponding 50-year facility lifetime risk from the same accident scenario for the population, maximum offsite individual, and worker at 1,000 m (3,280 ft), would be 2.1×10^{-6} , 1.4×10^{-8} , and 3.7×10^{-8} respectively. The maximum population 50-year facility lifetime risk would be 1.4×10^{-3} (that is, one fatality in about 36,000 years) at Pantex for the PCV penetration accident scenario with a probability of 0.064 per year. The corresponding maximum offsite individual and worker 50-year facility lifetime risks would be 9.2×10^{-6} and 2.3×10^{-5} , respectively. Section M.5 presents additional facility accident data and summary descriptions of the accident scenarios identified in Table 4.2.4.9–7.

Involved workers, those that would work in the facilities associated with the proposed action, may be subject to injury and, in some cases, fatality as a result of potential accidents. The locations of workstations, number of workers, personnel protective features, engineered safety features, and other design details affect the extent of

Table 4.2.4.9–7. Consolidation Alternative Accident Impacts at Pantex Plant

Accident Description	Worker at 1,000 m		Maximum Offsite Individual		Population to 80 km		Accident Frequency (per yr)
	Risk of Cancer Fatality (per 50 yr) ^a	Probability of Cancer Fatality ^b	Risk of Cancer Fatality (per 50 yr) ^a	Probability of Cancer Fatality ^b	Risk of Cancer Fatalities (per 50 yr) ^a	Number of Cancer Fatalities ^c	
PCV puncture by forklift	5.3×10^{-8}	1.8×10^{-6}	2.1×10^{-8}	7.1×10^{-7}	3.2×10^{-6}	1.1×10^{-4}	6.0×10^{-4}
PCV breach by firearms discharge	3.1×10^{-9}	1.8×10^{-7}	1.2×10^{-9}	7.1×10^{-8}	1.9×10^{-7}	1.1×10^{-5}	3.5×10^{-4}
PCV penetration by corrosion	2.3×10^{-5}	7.2×10^{-6}	9.2×10^{-6}	2.9×10^{-6}	1.4×10^{-3}	4.4×10^{-4}	0.064
Vault fire	1.9×10^{-8}	3.8×10^{-3}	7.5×10^{-9}	1.5×10^{-3}	1.1×10^{-6}	0.23	1.0×10^{-7}
Truck bay fire	1.2×10^{-9}	2.5×10^{-4}	4.9×10^{-10}	1.0×10^{-4}	7.6×10^{-8}	0.015	1.0×10^{-7}
Spontaneous combustion	1.2×10^{-11}	3.5×10^{-7}	4.9×10^{-12}	1.4×10^{-7}	7.6×10^{-10}	2.2×10^{-5}	7.0×10^{-7}
Explosion in the vault	2.9×10^{-9}	5.8×10^{-4}	1.2×10^{-9}	2.3×10^{-4}	1.8×10^{-7}	0.036	1.0×10^{-7}
Explosion outside of vault	1.3×10^{-11}	2.7×10^{-6}	5.3×10^{-12}	1.1×10^{-6}	8.2×10^{-10}	1.6×10^{-4}	1.0×10^{-7}
Nuclear criticality	9.7×10^{-12}	1.9×10^{-6}	4.6×10^{-12}	9.3×10^{-7}	1.2×10^{-10}	2.3×10^{-5}	1.0×10^{-7}
Beyond evaluation basis earthquake	3.7×10^{-8}	7.5×10^{-3}	1.4×10^{-8}	2.7×10^{-3}	2.1×10^{-6}	0.41	1.0×10^{-7}
Expected risk ^d	2.3×10^{-5}	–	9.3×10^{-6}	–	1.4×10^{-3}	–	–

^a The risk values are calculated by multiplying the probability of cancer fatality (for the worker at 1,000 m or the maximum offsite individual or the number of cancer fatalities (for the population to 80 km) by the accident frequency and the number of years of operation.

^b Increased likelihood (or probability) of cancer fatality to a hypothetical individual (a single onsite worker at a distance of 1,000 m or the site boundary, whichever is smaller or to a hypothetical individual in the offsite population located at the site boundary) if exposed to the indicated dose. The value assumes the accident has occurred.

^c Estimated number of cancer fatalities in the entire offsite population out to a distance of 80 km if exposed to the indicated dose. The value assumes the accident has occurred.

^d Expected risk is the sum of the risks over the 50-year lifetime of the facility.

Note: All values are mean values.

Source: Calculated using the source terms in Tables M.5.2.1.1–5 and M.5.2.1.1–6 and the MACCS computer code.

worker exposures to accidents. Certain accidents such as fires, explosions, and criticality could cause fatalities to workers close to the accident. Before construction of a new or modification of an existing facility, DOE Orders require detailed safety analyses to assure that facility designs and operating procedures limit the number of workers in hazardous areas and minimize risk of injury or fatality in the event of an accident.

Collocation Alternative

Construct New Plutonium and Highly Enriched Uranium Storage Facilities

This section includes a description of radiological and hazardous chemical releases and their associated impacts resulting from either normal operation or accidents involved with the consolidation of Pu storage and collocation with HEU storage facilities at Pantex. This storage would take place in a new Pu and HEU storage facility.

Normal operation of the new collocated storage facility at Pantex would result in emissions that are within applicable regulatory limits.

[Text deleted.]

Normal Operation. There would be no radiological releases during the construction of a new collocated storage facility at Pantex. Construction worker exposures to material potentially contaminated with

radioactivity (for example, from construction activities involved with existing contaminated soil) would be limited to assure that doses are maintained ALARA. Toward this end, construction workers would be monitored, as appropriate. Limited hazardous chemical releases are anticipated as a result of construction activities. However, concentrations would be within the regulated exposure limits. During normal operation, there would be both radiological and hazardous chemical releases to the environment and also direct in-plant exposures. The resulting doses and potential health effects to the public and workers are described below.

Radiological Impacts. Radiological impacts to the public resulting from the normal operation of the new collocated storage facility at Pantex are presented in Table 4.2.4.9–1. The impacts from all site operations, including the new storage plant, are also given in the table. To put operational doses into perspective, comparisons with doses from natural background radiation are included in the table.

The dose to the MEI from annual storage facility operation would be 9.6×10^{-6} mrem. From 50 years of operation, the corresponding risk of fatal cancer to this individual would be 2.4×10^{-10} . The impacts to the average member of the public would be less. As a result of storage facility operation in the year 2030, the population dose would be 5.3×10^{-5} person-rem. The corresponding number of fatal cancers in this population from 50 years of operation would be 1.3×10^{-6} .

The dose to the MEI from annual total site operations is within the radiological limits specified in NESHAPS (40 CFR Part 61, Subpart H) and DOE Order 5400.5, and would be 6.5×10^{-5} mrem. From 50 years of operation, the corresponding risk of fatal cancer to this individual would be 1.6×10^{-9} . The impacts to the average member of the public would be less. This activity would be included in a program to ensure that doses to the public are ALARA. As a result of total site operation in the year 2030, the population dose would be within the limit in proposed 10 CFR 834 and would be 3.3×10^{-4} person-rem. The corresponding number of fatal cancers in this population from 50 years of operation would be 8.3×10^{-6} .

Doses to onsite workers from normal operations are given in Table 4.2.4.9–2. Included are involved workers directly associated with the new storage facility, workers who are not involved with the new storage facility, and the entire workforce at Pantex. All doses are within regulatory limits and administrative control levels. The associated risks and numbers of fatal cancers among the different workers from 50 years of operation are included in the table. Dose to individual workers would be kept low by instituting badged monitoring and ALARA programs and also workers rotations. As a result of the implementation of these mitigation measures, the actual number of fatal cancers calculated would be lower for the operation of the facility.

Hazardous Chemical Impacts. Hazardous chemical impacts to the public and to the onsite worker resulting from the normal operations of the new consolidation of Pu and collocation with HEU storage facilities at Pantex are presented in Table 4.2.4.9–3. The impacts from all site operations, including the consolidation of Pu and collocation with HEU storage facilities, are also included in this table. Total site impacts which include the No Action impact plus the facility impacts, are provided. All analyses to support the values presented in this table are provided in Section M.3.

The HI to the MEI of the public is 2.0×10^{-4} and the cancer risk is 1.5×10^{-7} as a result of operation of the new consolidation of Pu and collocation with HEU storage facilities in the year 2030. The HI and cancer risk from hazardous chemicals would remain constant over 50 years of operation, because exposures would be expected to remain the same. The total site operation, including the new facility, would result in an HI of 5.9×10^{-3} and a cancer risk of 1.6×10^{-7} for the onsite worker in the year 2030 and would be expected to remain constant as a result of 50 years of operation.

The HI to the onsite worker would be 9.3×10^{-4} , and the cancer risk is 6.2×10^{-6} as a result of operation of the new consolidation of Pu and collocation with HEU storage facilities in the year 2030. The HI and cancer risk from hazardous chemicals would remain constant over 50 years of operation, because exposures would be expected to remain the same. The total site operation, including the new facility, would result in a HI of 7.1×10^{-3} ,

and a cancer risk of 6.7×10^{-6} for the onsite worker in the year 2030. This would be expected to remain constant as a result of 50 years of operation.

Facility Accidents. A set of potential accidents have been postulated for collocation of Pu and HEU for which there may be releases of Pu or HEU that may impact onsite workers and the offsite population. The consequences and risks of potential accidents that release both Pu and HEU would be bounded by the impacts associated with Pu. The accident consequences and risks to a worker located 1,000 m (3,280 ft) from the accident release point, the maximum offsite individual located at the site boundary, and the population located within 80 km (50 mi) of the accident release point are summarized in Table 4.2.4.9–8. For the set of accidents analyzed, the maximum number of cancer fatalities in the population within 80 km (50 mi) would be 0.41 at Pantex for the beyond design basis earthquake accident scenario with a probability of 1.0×10^{-7} per year. The corresponding 50-year facility lifetime risk from the same accident scenario for the population, maximum offsite individual, and worker at 1,000 m (3,280 ft), would be 2.1×10^{-6} , 1.4×10^{-8} , and 3.7×10^{-8} , respectively. The maximum population 50-year facility lifetime risk would be 1.4×10^{-3} (that is, one fatality in about 36,000 years) at Pantex for the PCV penetration by corrosion accident scenario with a probability of 0.064 per year. The corresponding maximum offsite individual and worker 50-year facility lifetime risks would be 9.2×10^{-6} and 2.3×10^{-5} , respectively. Section M.5 presents additional facility accident data and summary descriptions of the accident scenarios identified in Table 4.2.4.9–8.

Involved workers, those that would work in the facilities associated with the proposed action, may be subject to injury and, in some cases, fatality as a result of potential accidents. The locations of workstations, number of workers, personnel protective features, engineered safety features, and other design details affect the extent of worker exposures to accidents. Certain accidents such as fires, explosions, and criticality could cause fatalities to workers close to the accident. Before construction of a new or modification of an existing facility, DOE Orders require detailed safety analyses to assure that facility designs and operating procedures limit the number of workers in hazardous areas and minimize risk of injury or fatality in the event of an accident.

Subalternative Not Including Strategic Reserve and Weapons Research and Development Materials

If the strategic reserve and weapons R&D materials are not included, the impacts to the public and to workers from the accident-free storage activities would be reduced in proportion to the decrease in the amount of material stored. The impacts from total site operations would decrease slightly. This subalternative applies to the No Action Alternative, the Upgrade Alternative, the Consolidation Alternative, and the Collocation Alternative. The risks due to accidents would also tend to be lower.

Phaseout

Normal Operation. A phaseout of existing Pu storage facilities at Pantex would reduce the impacts from radiological and chemical releases and exposures to levels slightly below the No Action levels. All workers involved in the transfer of the Pu from existing storage would be monitored to assure that their doses remain within regulatory limits and as low as reasonably achievable.

Facility Accidents. The phaseout operation will be conducted in accordance with DOE Orders to ensure that the risk to the public of prompt fatalities due to accidents or of cancer fatalities due to operations will be minimized. For current operations in the facility that would be phased out, the safety of workers and the public from accidents is controlled by Technical Safety Requirements that are specified in SARs or Basis for Interim Operations documents that have been prepared for the facility. Prior to initiating phaseout, the potential for accidents that could impact workers and the public will be assessed and, if necessary, applicable existing safety documentation will be modified to ensure safety for workers and the public.

4.2.4.10 Waste Management

This section summarizes the impacts on waste management at Pantex under No Action and for each of the long-term storage alternatives to include the phaseout of Pu storage. There is no spent nuclear fuel or HLW associated with Pu or HEU storage. Table 4.2.4.10-1 lists the projected sitewide waste generation rates and treatment, storage, and disposal capacities under No Action for 2005. Projections for No Action were derived from the most recent available environmental data, with the appropriate adjustments made for those changing operational requirements where the volume of wastes generated are identifiable. The projection does not include wastes from future, yet uncharacterized, environmental restoration activities. The projections for No Action could change significantly depending on the decisions resulting from the PEIS on waste management being prepared by DOE or the Pantex EIS. Table 4.2.4.10-2 provides the estimated incremental operational waste volumes projected to be generated at Pantex as a result of the various storage alternatives prior to treatment. Some of the waste values described in this section are different than the waste values in the table. For those values that differ (for example, LLW), the table gives waste generated pre-treatment values and the text discusses post-treatment values (indicated as after treatment and volume reduction). The waste volumes generated from the various storage alternatives and the resultant waste effluent used for the waste impact analysis can be found in Section E.3.1. Facilities that would support the storage of Pu and/or HEU would treat and package all waste generated into forms that would enable staging and/or disposal in accordance with RCRA and other applicable statutes. Depending on decisions in waste-type-specific RODs for the Waste Management PEIS, wastes could be treated, and depending on the type of waste, disposed of onsite or at regionalized or centralized DOE sites. For the purposes of analyses only, this PEIS assumes that TRU and mixed TRU waste would be treated onsite to the current planning-basis WIPP WAC, and shipped to WIPP for disposal. This PEIS also assumes that LLW, mixed LLW, hazardous, and nonhazardous wastes would be treated and disposed of in accordance with current site practice.

No Action Alternative

Under this alternative, LLW, mixed LLW, hazardous, and nonhazardous waste would continue to be generated at Pantex from the missions outlined in Section 3.5. Pantex might also store, over the long term, certain quantities of pits from disassembled weapons, but minimal impacts on waste management is expected since such storage generates minimal additional waste.

Pantex's assembly/disassembly and HE programs would continue to generate low-level, mixed, hazardous, and nonhazardous wastes. Compactible components of solid LLW would continue to be processed at the onsite solid waste compaction facility. Mixed waste would be treated and disposed of according to the *Pantex Plant Federal Facility Compliance Act Site Treatment Plant/Compliance Plan* (September 1995) that was developed in accordance with the *Federal Facility Compliance Act*. Although the predominant workload in 1994 was disassembly operations, the activity levels were assumed to be representative of projected production levels that characterize No Action operations. It is expected that through waste minimization efforts generation rates would decrease.

Upgrade Alternative

Preferred Alternative: Upgrade With Rocky Flats Environmental Technology Site Plutonium Pits Subalternative

Modify Existing Zone 12 South Facilities for Continued Plutonium Storage

The upgrading of the existing Pantex storage facility for the continued storage of Pu would have a small impact on existing Pantex waste management activities. Construction waste volumes for the upgraded facility with RFETS Pu pits are presented in Table E.3.1.1-7. Upgrading the existing storage would have minimal impact on Pantex waste management activities. Waste generated during construction would consist of wastewater and solid nonhazardous and hazardous wastes. Nonhazardous waste would be disposed of as part of the construction

project by the contractor, and the hazardous waste would be shipped offsite to commercial RCRA-permitted treatment and disposal facilities. Operational waste volumes, as shown in Table 4.2.4.10-2, would increase slightly due to increased surveillance activities over No Action. [Text deleted].

Approximately 0.8 m^3 (1 yd^3) of TRU waste from damaged PCVs and contaminated glovebox panels, windows, and gaskets would need to be processed and packaged to meet the WIPP WAC or alternative treatment level. While awaiting shipment to WIPP (depending on decisions made in the ROD associated with the supplemental EIS being prepared for the proposed continued phased development of WIPP for disposal of TRU waste), the TRU waste would be stored in above-grade storage facilities. One truck shipment every 11 years or, if applicable, one regular train shipment every 23 years or one dedicated train shipment every 67 years would be required to transport this waste to WIPP.

After treatment and volume reduction, approximately 69 m^3 (90 yd^3) of LLW from solidified liquid LLW (such as decontamination solutions), protective clothing, HEPA filters, glovebox gloves, and decontamination equipment and materials would require disposal. Assuming a land usage of $6,000 \text{ m}^3/\text{ha}$ ($3,200 \text{ yd}^3/\text{acre}$), this would require 0.01 ha/yr (0.03 acre/yr) of LLW disposal area at NTS. Assuming 16.6 m^3 (21.7 yd^3) of LLW per shipment, five additional shipments per year from Pantex to NTS would be required.

Contaminated shielding and cleaning materials would be the major contributors to the 0.2 m^3 (50 gals) of liquid and 8 m^3 (10 yd^3) of solid mixed LLW. This small amount of mixed LLW could be treated and disposed of through the use of existing and planned facilities in accordance with the *Pantex Plant Federal Facility Compliance Act Site Treatment Plan/Compliance Plan* (September 1995).

The 1 m^3 (260 gal) of liquid hazardous wastes such as lubricants, cleaning solvents, paint, and lube oil and 1.5 m^3 (2 yd^3) of solid hazardous wastes such as lead packing, wipes, and solid materials contaminated with oils, lubricants, and cleaning solvents would have minimal impact on waste management activities at Pantex, as there is adequate storage capacity while awaiting shipment to a commercial RCRA-permitted treatment and disposal facility.

Approximately $12,900 \text{ m}^3$ (3,400,000 gal) of liquid nonhazardous wastes, including sanitary, utility, and process wastewaters, and cooling system blowdown, would be processed using existing and planned liquid nonhazardous waste facilities. After volume reduction, 138 m^3 (180 yd^3) of solid nonhazardous wastes such as clean non-Pu metals, packing materials, office trash, defective and damaged equipment, and industrial waste from utility and maintenance operations would be shipped to the currently utilized offsite landfill.

Upgrade Without Rocky Flats Environmental Technology Site Plutonium or Los Alamos National Laboratory Plutonium Subalternative

Modify Existing Zone 12 South Facilities for Continued Plutonium Storage

The Upgrade Without RFETS Pu or LANL Pu Subalternative is similar to the Upgrade With RFETS Pu Pits Subalternative because the modified facilities in Zone 12 South would be designed with adequate capacity to store all of the RFETS Pu pits. No additional resources would be required and therefore the impacts would be the same.

Upgrade With All or Some Rocky Flats Environmental Technology Site Plutonium and Los Alamos National Laboratory Plutonium Subalternative

Modify Existing Zone 12 South Facility for Continued Plutonium Storage

The impacts from the inclusion of RFETS and LANL material are bounded by the impacts from the Consolidation Alternative Construct New and Modify Existing Zone 12 South Facilities Option. The amount of

operational waste volumes would be larger than those presented above in the Upgrade Without RFETS or LANL Material Subalternative.

Consolidation Alternative

Construct New and Modify Existing Zone 12 South Facilities

Construction and operation of a consolidated Pu storage facility through an upgrade of existing facilities would have an impact on existing Pantex waste management activities, increasing the generation of TRU, low-level, mixed, hazardous, and nonhazardous wastes. Wastes generated during construction would consist of wastewater, nonhazardous solids, and hazardous wastes. The nonhazardous wastes would be disposed of as part of the construction project by the contractor, and the hazardous wastes would be shipped to commercial RCRA-permitted treatment and disposal facilities. No soil contaminated with hazardous material or radioactive constituents is expected to be generated during construction. However, if any was generated it would be managed in accordance with site practice and all applicable Federal and State regulations. The types of operational wastes from the consolidated Pu storage facility would be same as those from the Pu Storage Upgrade, but the quantity would change, as shown in Table 4.2.4.10–2.

After treatment and volume reduction of TRU waste, approximately 5 m^3 (7 yd^3) of TRU waste and 4 m^3 (5 yd^3) of mixed TRU waste from leaded gloves and windows, and contaminated Pb shielding would be treated and packaged to meet the current planning-basis WIPP WAC or alternative treatment level. While awaiting shipment to WIPP (depending on decisions resulting from the supplemental EIS noted earlier), the TRU and mixed TRU waste would be stored in above-ground storage facilities. One additional truck shipment per year or, if applicable, one regular train shipment every 2 years or one dedicated train shipment every 6 years would be required to transport these wastes to WIPP or an alternate facility.

Following treatment and volume reduction, approximately 630 m^3 (824 yd^3) of LLW would require disposal at NTS. This would require approximately 0.1 ha/yr (0.3 acre/yr) of LLW disposal area and 38 additional LLW shipments to NTS. The 0.2 m^3 (50 gal) of liquid mixed LLW and 65 m^3 (85 yd^3) of solid mixed LLW would be treated and disposed of through the use of existing and planned facilities according to the Pantex Site Treatment Plan. The 2 m^3 (476 gal) of liquid and 2 m^3 (3 yd^3) of solid hazardous wastes would have a minimal impact on waste management activities at Pantex, as there is adequate storage capacity while awaiting shipment to a commercial RCRA-permitted treatment and disposal facility.

Approximately $109,500 \text{ m}^3$ (28,900,000 gal) of liquid nonhazardous wastes would be processed using existing and planned liquid nonhazardous waste facilities. After volume reduction, 780 m^3 ($1,020 \text{ yd}^3$) of solid nonhazardous wastes would require disposal at the offsite landfill.

Construct New Plutonium Storage Facility

Construction and operation of a consolidated Pu new storage facility would have an impact on existing Pantex waste management activities by increasing the generation of TRU, low-level, mixed, hazardous, and nonhazardous wastes. Waste generated during construction would consist of wastewater, nonhazardous solids, and hazardous wastes. The nonhazardous wastes would be disposed of as part of the construction project by the contractor, and the hazardous wastes would be shipped to commercial RCRA-permitted treatment and disposal facilities. No soil contaminated with hazardous material or radioactive constituents is expected to be generated during construction. However, if any was generated it would be managed in accordance with site practice and all applicable Federal and State regulations. The impacts from TRU, low-level, mixed, and hazardous wastes are identical to those identified in the consolidation through upgrade analysis.

The 97,800 m³ (25,800,000 gal) of liquid nonhazardous wastes would be processed in existing and planned facilities. After volume reduction, 720 m³ (942 yd³) of solid nonhazardous wastes would require disposal at the offsite landfill.

Collocation Alternative

Construct New Plutonium and Highly Enriched Uranium Storage Facilities

Construction and operation of a consolidated Pu storage facility collocated with HEU storage would have an impact on existing Pantex waste management activities by increasing the generation of TRU, low-level, mixed, hazardous, and nonhazardous wastes. Waste generated during construction would consist of wastewater, nonhazardous solids, and hazardous wastes. The nonhazardous wastes would be disposed of as part of the construction project by the contractor, and the hazardous wastes would be shipped to commercial RCRA-permitted treatment and disposal facilities. No soil contaminated with hazardous material or radioactive constituents is expected to be generated during construction. However, if any was generated it would be managed in accordance with site practice and all applicable Federal and State regulations.

Because there is no TRU or mixed TRU waste associated with HEU storage, the impacts from TRU and mixed TRU wastes are identical to those identified in the consolidated Pu storage alternative. The sources of waste are similar to those of the upgraded Pu storage facility, except the source of radioactive contamination from the HEU storage is uranium. Operational waste volumes are shown in Table 4.2.4.10–2.

Following treatment and volume reduction, approximately 630 m³ (824 yd³) of LLW contaminated with Pu and 20 m³ (26 yd³) of LLW contaminated with uranium would require disposal at NTS. This would require approximately 0.1 ha/yr (0.3 acre/yr) of LLW disposal area and 39 additional LLW shipments to NTS. The 0.2 m³ (55 gal) of liquid mixed LLW and 66 m³ (86 yd³) of solid mixed LLW would be treated and disposed of through the use of existing and planned facilities according to the *Pantex Site Treatment Plan*. The 2 m³ (528 gal) of liquid and 2 m³ (3 yd³) of solid hazardous wastes would have a minimal impact on waste management activities at Pantex, as there is adequate storage capacity while awaiting shipment to a commercial RCRA-permitted treatment and disposal facility. The 129,500 m³ (34,200,000 gal) of liquid nonhazardous wastes would be processed in existing and planned facilities. After volume reduction, the 920 m³ (1,200 yd³) of solid nonhazardous wastes would require disposal at the offsite landfill.

Subalternative Not Including Strategic Reserve and Weapons Research and Development Materials

The exclusion of strategic reserve and weapons R&D materials would reduce the amount of operational waste volumes shown in Table 4.2.4.10–2 for the No Action Alternative, the Upgrade Alternative, the Consolidation Alternative, and the Collocation Alternative. The decrease would be proportional to the amount of material excluded. [Text deleted.]

Phaseout

The phaseout of Pu storage would have no impact on Pantex waste management activities. The volume of waste would not decrease in any measurable quantity until the facilities in which Pu is stored were D&D.

4.2.5 OAK RIDGE RESERVATION

A listing of the proposed long-term storage alternatives, subalternatives, and related actions, including the No Action Alternative, at ORR is provided below. The potential impacts of implementing these alternatives and related actions at ORR are described in the following sections: land resources, site infrastructure, air quality and noise, water resources, geology and soils, biological resources, cultural and paleontological resources, socioeconomics, public and occupational health and safety, and waste management. The specific long-term storage alternatives proposed for ORR are the Upgrade Alternative, the Consolidation Alternative, and the Collocation Alternative.

Preferred Alternative

Modify Existing Y-12 Plant For Continued HEU Storage Subalternative:

Upgrade existing storage facilities at Y-12 to meet natural phenomena requirements. Consolidate storage facilities and reduce storage footprint as surplus HEU disposition is performed pursuant to the HEU EIS.

Proposed Storage Activities at Oak Ridge Reservation

- **No Action Alternative:** Continue to store ORR nonsurplus HEU material within the scope of this PEIS at Y-12 in stabilized form in accordance with the *Environmental Assessment for the Proposed Interim Storage of Enriched Uranium Above the Maximum Historical Storage Level at the Y-12 Plant, Oak Ridge, Tennessee*.
- **Upgrade Alternative:**
 - ***Modify Existing Y-12 Plant For Continued HEU Storage Subalternative (Preferred Alternative):*** Upgrade existing storage facilities at Y-12 to meet natural phenomena requirements. Consolidate storage facilities and reduce storage footprint as surplus HEU disposition is performed pursuant to the HEU EIS.
- [Text deleted.]
- **Consolidation Alternative:** This storage alternative does not apply to ORR. Siting the consolidated Pu storage facility at ORR would create an HEU collocation condition and is analyzed as part of the Collocation Alternative.
- **Collocation Alternative:** Three options to accommodate all Pu and HEU material within the scope of this PEIS:
 - ***Construct New Plutonium Storage Facility; Maintain Existing Highly Enriched Uranium Storage Facilities at Y-12 Plant:*** Construct a new consolidated Pu storage facility east of K-25 and west of ORNL; existing buildings at Y-12 would continue to store ORR nonsurplus HEU material.

Proposed Storage Activities at Oak Ridge Reservation—Continued

- ***Construct New Plutonium Storage Facility and Modify Existing Highly Enriched Uranium Storage Facilities at Y-12 Plant:*** Construct a new consolidated Pu storage facility east of K-25 and west of ORNL and modify existing Y-12 buildings storing ORR nonsurplus HEU material to comply with all ES&H requirements that include improving the capability of facilities to meet design basis seismic events and tornadoes.
- ***Construct New Plutonium and Highly Enriched Uranium Storage Facility:*** Construct a new collocated Pu and HEU storage facility east of K-25 and west of ORNL.
- **Subalternative Not Including Strategic Reserve and Weapons Research and Development Materials:** Facility and other resource requirements would be smaller than the No Action Alternative, the Upgrade Alternative, the Consolidation Alternative, and the Collocation Alternative.
- **Phaseout:** ORR nonsurplus HEU material within the scope of this PEIS would be moved out of Y-12 to the collocation site (located at another DOE site).

4.2.5.1 Land Resources

No Action Alternative

Under this alternative, nonsurplus HEU would continue to be stored in stabilized form in accordance with the *Environmental Assessment for the Proposed Interim Storage of Enriched Uranium Above the Maximum Historical Storage Level at the Y-12 Plant, Oak Ridge, Tennessee*, at the current Y-12 Plant interim storage location. The ongoing (no new action) activities conform with present and future land-use plans, policies, and controls. Therefore, no direct or indirect effects to land resources would be anticipated beyond the effects of existing and future activities that are independent of the Proposed Action.

Upgrade Alternative

Preferred Alternative: Modify Existing Y-12 Plant for Continued Highly Enriched Uranium Storage

The ORR nonsurplus HEU inventory requiring storage until final disposition would be stored at Y-12 in existing modified facilities; no new facilities would be built. Therefore, there would be no land disturbance or additional land area required. The majority of this HEU would be housed in facilities currently utilized for HEU storage. The remaining HEU would be stored in facilities that are currently being converted into storage areas. Five existing Y-12 plant facilities would be used for the long-term HEU storage mission.

Land Use. Upgrading the existing HEU storage facility would not change land use. The upgrade would conform with the current *Oak Ridge Reservation Site Development and Facilities Utilization Plan*, which notes that Y-12 is the national storage repository for HEU (OR DOE 1989a:3-5). [Text deleted.] As discussed in Section 4.2.5.8, no in-migration of construction or operation workers is anticipated. Therefore, no indirect effects to offsite land use would occur.

No prime farmlands exist onsite. The upgrade would not be in conflict with city of Oak Ridge land-use plans, policies, and controls since the current *Oak Ridge Area Land Use Plan* designates the potential site for industrial use. Offsite land use would not be affected.

Visual Resources. Because this alternative proposes to modify existing facilities, potential impacts to visual resources would not be caused by the upgrade. The current VRM Class 5 designation of Y-12 would remain.

Collocation Alternative

Construct New Plutonium Storage Facility; Maintain Existing Highly Enriched Uranium Storage Facilities at Y-12 Plant

This option assumes the use of existing storage, No Action for HEU (continued storage of ORR nonsurplus HEU material at Y-12 until final disposition), and construction of a new Pu storage facility east of K-25 and west of ORNL near the intersection of Route 95 and Bear Creek Road, to accommodate all Pu within the scope of this PEIS. Although No Action for HEU would not disturb land or require additional land area, construction of the new consolidated Pu facility would disturb 58.5 ha (144 acres) of land area during construction of which 56 ha (138 acres) of land area would be used during operations. The facility would be sited in a buffer zone less than 1.6 km (1 mi) from the site boundary.

Land Use. Construction and operation of the consolidated Pu storage facility would change the existing forested/undeveloped land use of the potential facility site located near the intersection of Route 95 and Bear Creek Road. A portion of the consolidated proposed facility location is situated in the NERP. The future land-use plan of the current *Oak Ridge Reservation Site Development and Facilities Utilization Plan* designates a portion of the potential site as a Waste Management Area (OR DOE 1991f:5-3). Therefore, potential direct land-use impacts could occur for the Pu consolidation facilities. No direct effects to land use or visual resources are anticipated with No Action for HEU. As discussed in Section 4.2.5.8, expected vacancies and historic housing construction rates indicate that there would be sufficient housing available to accommodate in-migrant construction and operational workers and their families. Therefore, no indirect impacts to offsite land use would occur.

The option would affect the use of the NERP, but other ORR land uses would not be affected. No prime farmlands exist onsite. The option would not be in conflict with the city of Oak Ridge land-use plans, policies, and controls since the current *Oak Ridge Area Land Use Plan* designates the potential site for Industrial and/or Public land use depending on the exact location chosen.

Visual Resources. [Text deleted.] Construction and operation of the consolidation facility would change the current VRM Class 4 designation of the Bear Creek Road/Route 95 site to Class 5, which would cause potential visual impacts to Bear Creek Road and Route 95, public roadways with high sensitivity levels. Construction and operation activities and facility development on the environmentally sensitive (wooded and steep slopes) site would be highly visible from these roadways and would alter the existing landscape character.

Construct New Plutonium Storage Facility and Modify Existing Highly Enriched Uranium Storage Facilities at Y-12 Plant

This option includes the construction of a new Pu storage facility at ORR east of K-25 and west of ORNL near the intersection of Route 95 and Bear Creek Road and modification of the existing HEU storage facility at Y-12. The option would disturb 58.5 ha (144 acres) of land area during construction of which 56 ha (138 acres) would be used during operations. The facility would be sited in a buffer zone less than 1.6 km (1 mi) from the site boundary.

Land Use. Land-use effects at the Bear Creek Road/Route 95 site would be similar to the Collocation Alternative new Pu storage facility. Upgrading the existing HEU storage facilities at Y-12 would not change land use; the upgrade would conform with the current *Oak Ridge Reservation Site Development and Facilities Utilization Plan* (OR DOE 1989a:3-5). As discussed in Section 4.2.5.8, expected vacancies and historic construction rates indicate that there would be sufficient housing available to accommodate in-migrant construction and operational workers and their families. Therefore, no indirect effects to offsite land use would occur as a result of the option.

Impacts to other ORR land uses, special status lands, and potential conflicts with the city of Oak Ridge land-use plans, policies, and controls would be similar to the Collocation Alternative new Pu storage facility.

Visual Resources. Visual resources effects at the Bear Creek Road/Route 95 site would be similar to the Collocation Alternative new Pu storage facility. However, the magnitude and extent of potential visual effects could be greater due to the larger area of land disturbed. Potential effects of the Y-12 upgrade on the sensitive viewpoints and special status lands would not occur; the existing VRM Class 5 designation of the Y-12 Plant would remain.

Construct New Plutonium and Highly Enriched Uranium Storage Facilities

Under this option, all HEU within the scope of this PEIS would be stored at a primary new storage plant, collocated with the Pu storage plant at ORR on undisturbed land east of K-25 and west of ORNL near the

intersection of Route 95 and Bear Creek Road. Pu and HEU storage in existing DOE storage facilities would be phased out. The collocated storage plant would require a total of 23 buildings, the majority of which would be one level. No structure would exceed three levels. Land disturbance would be 89.5 ha (221 acres) during construction of which 87 ha (215 acres) would be used during operation. A buffer zone less than 1.6 km (1 mi) would be provided between facilities and the ORR site boundary. Although more land area would be disturbed, impacts to land resources would be similar to the Collocation Alternative new Pu storage facility.

Subalternative Not Including Strategic Reserve and Weapons Research and Development Materials

Under this subalternative, land effects during construction and operation would be almost the same in extent and magnitude to the No Action Alternative, Upgrade Alternative, and Collocation Alternative because the facility would be almost the same. However, because the smaller quantity of material would require smaller facilities, it is likely that less land area would be disturbed during construction and used during operations. [Text deleted.]

Phaseout

Phaseout of the current HEU storage mission would not require additional land area or new construction. ORR nonsurplus HEU material would be moved out of Y-12 to the collocation site. Potential impacts to visual resources could occur if facilities are not maintained.

[Text deleted.]

4.2.5.2 Site Infrastructure

The ORR site is capable of supporting all of its proposed storage alternatives without major infrastructure modification. Table 4.2.5.2–1 presents a comparison of the annual operating infrastructure resource requirements relative to the availability or capacity for the onsite transportation network, electrical power, and fuel supply.

No Action Alternative

Under this alternative, storage of HEU materials would continue at the Y–12 facility. ORR does not currently store Pu-bearing materials in the form or quantity that would be within the scope of this PEIS, and under No Action no Pu would be shipped to ORR. [Text deleted.] All infrastructure requirements are within site capacities.

Upgrade Alternative

Preferred Alternative: Modify Existing Y–12 Plant for Continued Highly Enriched Uranium Storage

Construction of the Y–12 upgrade to accommodate long-term storage of existing quantities of HEU at ORR would not affect the site infrastructure. Data for construction are presented in Appendix C. Some additional coal would be needed. Since coal availability is governed by usage and not by storage capacity, the additional coal required could be procured through normal contractual means. Site infrastructure requirements for operations are within existing site capacities. As a result, there would be minimal impacts on the site infrastructure.

Collocation Alternative

Construct New Plutonium Storage Facility; Maintain Existing Highly Enriched Uranium Storage Facilities at Y–12 Plant

This option assumes that No Action for HEU storage is taken at Y–12, but that storage for Pu is provided. Construction of the consolidated Pu storage facility at ORR would not affect the site infrastructure. Data for construction are presented in Appendix C. Operations impacts to the ORR infrastructure under this option would be minimal.

Construct New Plutonium Storage Facility and Modify Existing Highly Enriched Uranium Storage Facilities at Y–12 Plant

Construction of a new consolidated Pu storage facility to provide long-term storage of Pu at ORR and modifying Y–12 for long-term HEU storage would not affect the site infrastructure. Data for construction are presented in Appendix C. Operations impacts to the ORR infrastructure under this option would be minimal. As shown in Table 4.2.5.2–1, less than 5 km (3 mi) of roads and less than 10 km (6 mi) of railroad lines would need to be added to the site to accommodate the facility. Also, some additional coal and oil would be needed. Since coal and oil availability is governed by usage and not by storage capacity, the additional coal and oil required could be procured through normal contractual means. All other infrastructure requirements are within site capacities.

Construct New Plutonium and Highly Enriched Uranium Storage Facilities

Construction of a new consolidated Pu and HEU storage facility at ORR would consume approximately 25 percent more materials and resources than building the consolidated Pu storage facility and modifying the existing Y–12 HEU storage facility. However, the impact of constructing these facilities is not expected to result

**Table 4.2.5.2-1. Site Infrastructure Changes Required for Operation at Oak Ridge Reservation (Annual)—
No Action (2005) and Storage Alternatives**

Alternative	Transportation		Electrical		Fuel		
	Roads (km)	Railroad (km)	Energy (MWh/yr)	Peak Load (MWe)	Oil (l/yr)	Natural Gas (m ³ /yr)	Coal (t/yr)
No Action							
Site Availability	71	27	13,880,000	2,100	416,000	250,760,000	16,300
Projected usage	71	27	726,000	110	379,000	95,000,000	16,300
Upgrade							
Projected usage	71	27	733,260	111	379,000	95,000,949	16,460
Amount required in excess to site availability	0	0	0	0	0	0	160
Collocation							
<i>New Pu Storage Facility Only</i>							
Projected usage	76	37	779,000	119	427,000	95,000,000	21,800
Amount required in excess to site availability	<5	<10	0	0	11,000	0	5,500
<i>New Pu Storage Facility and Modify Y-12</i>							
Projected usage	76	37	786,260	120	427,000	95,000,949	21,963
Amount required in excess to site availability	<5	<10	0	0	11,000	0	5,663
<i>New Pu and HEU Storage Facilities</i>							
Projected usage	78	37	779,480	119	429,000	94,998,103	22,273
Amount required in excess to site availability	<7	<10	0	0	13,000	0	5,973
Phaseout							
Projected usage	71	27	711,480	108	379,000	94,998,103	15,973
Amount required in excess to site availability	0	0	0	0	0	0	0

Source: DOE 1996e; DOE 1996f; OR LMES 1995e; ORR 1995a:2.

in any significant effects at ORR. Operations impacts to the ORR infrastructure under this option would be minimal. As shown in Table 4.2.5.2-1, less than 7 km (4 mi) of roads and less than 10 km (6 mi) of railroad lines would need to be added to the site to accommodate these facilities. Additional coal and oil required for operations would be procured as stated above for the consolidated Pu storage facility.

Subalternative Not Including Strategic Reserve and Weapons Research and Development Materials

Since the existing ORR site infrastructure would be capable of supporting construction/modification and operation of facilities for the No Action Alternative, the Upgrade Alternative, and the Collocation Alternatives, constructing and operating such facilities without including provisions for storage of strategic reserve and weapons R&D materials could be accommodated as well. Expected reductions in amounts of annual electrical requirements for the various storage facilities are the only site infrastructure changes expected if this subalternative is chosen because electric usage is dependent on the amount of material. [Text deleted.]

Phaseout

Phaseout of the HEU storage mission at Y-12 would have little or no impact on the facilities or site infrastructure. Facilities would need to be decontaminated and decommissioned prior to reuse or dismantlement, and any D&D, if proposed, would be accompanied by further NEPA analysis. The decrease in the annual consumption of utility resources is a small fraction (about 2 percent) of the existing annual usage.

4.2.5.3 Air Quality and Noise

Construction and operation activities associated with the No Action Alternative and the proposed storage alternatives would generate criteria and toxic/hazardous pollutants. To evaluate the air quality impacts at ORR, criteria and toxic/hazardous concentrations from the No Action Alternative and the proposed storage alternatives are compared with Federal and State standards and guidelines. Impacts from radiological airborne emissions are described in Section 4.2.5.9.

In general, all of the proposed storage facilities would emit the same types of air pollutants during construction. It is expected emissions would not exceed Federal, State, or local air quality regulations. PM₁₀ and TSP concentrations will be increased, especially during peak construction periods.

The principal sources of emissions during construction include the following:

- Fugitive dust from land clearing, site preparation, excavation, and wind erosion of exposed ground surfaces
- Exhaust and road dust generated by construction equipment, vehicles delivering construction materials, and vehicles carrying construction workers

During operation, concentrations of criteria and toxic/hazardous air pollutants emitted by the individual storage facilities are predicted to be in compliance with Federal, State, and local air quality regulations or guidelines. Table 4.2.5.3–1 presents the estimated pollutant concentrations for each of the storage alternatives, indicating little difference between alternatives with respect to impacts to air quality.

Emission rates attributed to operation of the proposed storage facilities are presented in Tables F.1.3–1 and F.1.3–3. [Text deleted.] Air pollutant emission sources associated with operations include the following:

- Operation of existing boilers for space heating
- Operation of diesel generators and periodic testing of emergency diesel generators
- Exhaust and road dust generated by vehicles delivering supplies and bringing employees to work
- Toxic/hazardous pollutant emissions from facility processes

Noise impacts during either construction or operation are expected to be low. Air quality and noise impacts for each storage alternative are described separately. Supporting data for the air quality and noise analyses are presented in Appendix F.

AIR QUALITY

An analysis was conducted of the potential air quality impacts of emissions from each of the storage alternatives as described in Section 4.1.3. Section 176 (c) of the 1990 CAA Amendments requires that all Federal actions conform with the applicable SIP. The EPA has implemented rules that establish the criteria and procedures governing the determination of conformity for all Federal actions in nonattainment and maintenance areas. These are discussed in Section 4.1.3. The attainment status of the area in which ORR is located is discussed in Section 3.6.3. Since the area is considered an attainment area for criteria pollutants, the proposed actions at this site do not require that a conformity analysis be performed.

No Action Alternative

This alternative utilizes estimated air emissions data from operations at ORR assuming continuation of site missions as described in Section 3.6. These data reflect conservative estimates of criteria and toxic/hazardous emissions at ORR. The emission rates for the criteria and toxic/hazardous pollutants for No Action for the total site are presented in Table F.1.2.6–1. Table 4.2.5.3–1 presents the No Action concentrations. During dry and windy conditions increased PM₁₀ and TSP concentrations may occur due to ongoing construction associated with other activities (that are outside the scope of this PEIS) under the No Action Alternative. Concentrations of all other criteria and toxic/hazardous air pollutants at the site boundary or public-access highways are expected to remain within applicable Federal, State, and local ambient air quality standards.

Upgrade Alternative

Preferred Alternative: Modify Existing Y-12 Plant for Continued Highly Enriched Uranium Storage

It is expected that concentrations of pollutants at the site boundary or public access highways would remain within applicable Federal and State ambient air quality standards during upgrade of facilities for continued HEU storage.

During operation, concentrations of criteria and toxic/hazardous air pollutants are predicted to be in compliance with Federal, State, and local air quality regulations or guidelines. Estimated pollutant concentrations attributable to increased operations associated with this storage alternative, plus the No Action concentrations, are presented in Table 4.2.5.3–1.

Collocation Alternative

Construct New Plutonium Storage Facility; Maintain Existing Highly Enriched Uranium Storage Facilities at Y-12 Plant

In addition to the types of sources of emissions during construction associated with the No Action and the Upgrade Alternative, fugitive dust resulting from the operation of a concrete batch plant would be an additional emission source associated with this storage alternative.

Increased PM₁₀ and TSP concentrations may occur during the peak construction period, particularly during dry and windy conditions. Appropriate control measures would be followed to minimize pollutant concentrations during construction. Concentrations of all pollutants at the site boundary or public-access highways would remain within applicable Federal and State ambient air quality standards during construction.

During operation, concentrations of criteria and toxic/hazardous air pollutants are predicted to be in compliance with Federal, State, and local air quality regulations or guidelines. Estimated pollutant concentrations attributable to increased operations associated with this storage alternative, plus the No Action concentrations, are presented in Table 4.2.5.3–1.

Construct New Plutonium Storage Facility and Modify Existing Highly Enriched Uranium Storage Facilities at Y-12 Plant

Air quality impacts for construction for this option are expected to be similar to those discussed previously for the new Pu storage facility only option.

During operation, concentrations of criteria and toxic/hazardous air pollutants are predicted to be in compliance with Federal, State, and local air quality regulations or guidelines. Estimated pollutant concentrations attributable to increased operations associated with this storage alternative, plus the No Action concentrations, are presented in Table 4.2.5.3–1.

Construct New Plutonium and Highly Enriched Uranium Storage Facilities

Air quality impacts for construction for this option are expected to be similar to those discussed previously for the new Pu storage facility only option.

During operation, concentrations of criteria and toxic/hazardous air pollutants are predicted to be in compliance with Federal, State, and local air quality regulations or guidelines. Estimated pollutant concentrations attributable to increased operations associated with this storage alternative, plus the No Action concentrations, are presented in Table 4.2.5.3–1.

Subalternative Not Including Strategic Reserve and Weapons Research and Development Materials

Air quality impacts for construction and operation for this subalternative are expected to be similar to those described previously for the No Action Alternative, the Upgrade Alternative, and the Collocation Alternative. [Text deleted.]

Phaseout

Phaseout of existing HEU inventories as a result of consolidating HEU at another site is expected to result in a small reduction in air pollutant concentrations from the No Action concentrations and would be in compliance with Federal and State standards.

NOISE

The location of the storage facilities relative to the site boundary and sensitive receptors was examined to evaluate the potential for onsite and offsite noise impacts.

Noise sources during construction may include heavy construction equipment and increased traffic. Increased traffic would occur onsite and along offsite local and regional transportation routes used to bring construction material and workers to the site.

No Action Alternative

Nontraffic noise sources associated with continued interim storage and other ongoing missions are the same as described in Chapter 3. The continuation of operations at ORR would result in no appreciable change in traffic noise and onsite operational noise sources from current levels. Nontraffic noise sources are located at sufficient distance from offsite areas that the contribution to offsite noise levels would continue to be small. Due to the size of the site, noise emissions from construction equipment and operations activities would not be expected to cause annoyance to the public. Some noise sources may result in impacts, such as disturbance of wildlife.

Upgrade (Preferred Alternative) and Collocation Alternatives

Nontraffic noise sources associated with the storage alternatives would be similar to those for existing facilities as discussed in Chapter 3. Nontraffic, operational noise sources associated with the storage alternatives include existing or additional equipment and machines (cooling systems, vents, motors, and material handling equipment). These noise sources would be located at sufficient distance from offsite areas that the contribution

to offsite noise levels would be small. Due to the size of the site, noise emissions from construction equipment and operations activities would not be expected to cause annoyance to the public. Some noise sources may result in impacts, such as disturbance of wildlife.

Subalternative Not Including Strategic Reserve and Weapons Research and Development Materials

Noise impacts for construction and operations for this option are expected to be almost the same as those previously described for the No Action Alternative, the Upgrade Alternative, and the Collocation Alternative because noise impacts are based on the use of the facility and not the size.

Phaseout

A reduction in noise levels associated with facility operations may result from the phaseout of storage facilities.

4.2.5.4 Water Resources

Impacts associated with the long-term storage options at ORR would affect water resources. The proposed upgrade storage facilities are located outside any 100-year and 500-year floodplain boundaries. No 100- or 500-year floodplain assessments have been conducted at the area proposed for the Collocation Alternative. This could be developed during the siting process. At ORR, surface water resources, primarily the Clinch River, would be used to meet all construction and operation water requirements. The Clinch River has sufficient flow to support any of the alternatives. No construction- or operation-related water withdrawal would exceed 1 percent of the Clinch River's average flow. During construction and operation of the facilities, treated wastewater would be discharged in compliance with permit requirements to nearby streams. Stormwater runoff would be collected, and treated, if necessary, before discharge to natural drainage channels in accordance with permit requirements. [Text deleted.]

Minimal impacts to groundwater are anticipated because no groundwater would be withdrawn and no direct discharges would occur during construction or operation. Table 4.2.5.4-1 presents No Action water resources uses and discharges and the potential changes to water resources at ORR resulting from the long-term storage alternatives.

No Action Alternative

Surface Water. [Text deleted.] A description of the activities that would continue at ORR is provided in Section 3.6. Under this alternative, because of increased operating requirements of existing facilities at ORR, surface water withdrawals from the Clinch River are expected to increase from the current usage of 14,210 million l/yr (3,750 million gal/yr) to 14,760 million l/yr (3,900 million gal/yr), or 0.35 percent of the river's average flow (132 m³/s [4,647 ft³/s]) by the year 2005. Wastewater discharges from Y-12 would continue to East Fork Poplar Creek and Bear Creek, although the volume is expected to increase. As discussed in Section 3.6.4, DOE is currently involved with remediation of East Fork Creek under CERCLA. Under this alternative, current restoration programs would continue.

Groundwater. Under this alternative, no additional impacts to groundwater resources are anticipated beyond those of existing and future activities, which are independent of and unaffected by the proposed action. Currently, one well supplies a small amount of water for a laboratory. Groundwater use is expected to remain constant in 2005.

Water quality data obtained from wells located near the Y-12 facility indicate that water quality has improved near site operations. Under this alternative, current restoration programs would continue. Process and wastewater would continue to be treated at either the Y-12 centralized pollution control facility or at the Y-12 west end treatment facility before being discharged to surface waters. Minimal impacts on groundwater quality are expected due to wastewater releases.

Upgrade Alternative

Preferred Alternative: Modify Existing Y-12 Plant for Continued Highly Enriched Uranium Storage

Surface Water. Water required for construction and operation of the upgraded HEU storage facilities would be provided via existing distribution systems. The source of this water is the Clinch River and its tributaries. [Text deleted.]

During construction, the quantity of water required would be approximately 3.0 million l/yr (0.79 million gal/yr), which would represent a much less than 1-percent increase over the projected No Action surface water withdrawal. This additional withdrawal would cause minimal impacts. During operation, water requirements would be approximately 0.24 million l/yr (0.063 million gal/yr). Supplying this quantity of water would have minimal impacts.

During construction of the upgraded HEU storage facilities, sanitary wastewater (approximately 3.0 million l/yr [0.8 million gal/yr]) would be generated and discharged to the existing Oak Ridge wastewater treatment facility. This would represent a much less than 1-percent increase in the effluent from this facility. During operation, additional sanitary wastewater (0.001 million l/yr [264 gal/yr]) would be discharged to this wastewater treatment system. This would represent a negligible increase in the effluent from this facility. Stormwater runoff would be collected and treated, if necessary, before discharge to natural drainage channels. These additional quantities are insignificant. All discharges would be monitored to comply with permit limits and other discharge requirements.

As discussed in Section 3.6.4, DOE is currently involved with remediation of East Fork Poplar Creek under CERCLA. Any discharges that may influence and potentially impact East Fork Poplar Creek would require engineering design measures to avoid interference with the goals of the remediation effort. All potential HEU storage locations are outside both the 100- and 500-year floodplains.

Groundwater. No groundwater would be used for any project-related water requirements, and no wastewater would be discharged directly to groundwater. Therefore, neither groundwater quality nor availability would be affected. In addition, because there would be no direct discharges to the environment, limestone deposits located beneath the plant would not be a factor for future contamination.

Collocation Alternative

Construct New Plutonium Storage Facility; Maintain Existing Highly Enriched Uranium Storage Facilities at Y-12 Plant

Surface Water. During construction of the facilities, approximately 85 million l/yr (22.5 million gal/yr) would be supplied from the Clinch River. This amount equates to approximately a 0.6-percent increase in annual water use and much less than 1 percent of the Clinch River flow. During operation, water requirements would be 280 million l/yr (74 million gal/yr), representing a 1.9-percent increase in projected water use and much less than 1 percent of the Clinch River flow. Supplying this amount would cause minimal impacts.

During construction, approximately 7.8 million l/yr (2.1 million gal/yr) of sanitary wastewater would be generated, treated, and discharged to the existing Oak Ridge wastewater treatment facility. This would represent a 0.3-percent increase in the effluent from this facility. During operation, additional sanitary wastewater (137 million l/yr [36.2 million gal/yr]) would be discharged to this wastewater treatment system. All discharges would be monitored to comply with discharge requirements.

No 100- or 500-year floodplain assessments have been conducted for the new collocated facilities. This would be developed during the siting process.

Groundwater. No groundwater would be used for any project-related water requirements and no wastewater would be discharged directly to groundwater. Therefore, neither groundwater quality nor availability would be affected. In addition, because there would be no direct discharges to groundwater, limestone deposits located beneath the plant would not be a factor for future groundwater contamination transportation.

Construct New Plutonium Storage Facility and Modify Existing Highly Enriched Uranium Storage Facilities at Y-12 Plant

Surface Water. The water requirements during construction and operation of the new consolidated Pu storage facility and upgraded Y-12 are slightly higher than those discussed for the Pu storage facility only. The water requirements are approximately 88 million l/yr (23.2 million gal/yr) during construction and 280.2 million l/yr (74 million gal/yr) during operation, which would represent about a 0.6- and 1.9-percent increase, respectively, over the projected No Action surface water withdrawal. These amounts each represent much less than 1 percent of the Clinch River flow and would cause minimal impacts to river levels.

During construction of the facilities, sanitary wastewater (10.8 million l/yr [2.3 million gal/yr]) would be generated and discharged to the treatment facility. During operations, additional sanitary wastewater (137 million l/yr [36.2 million gal/yr]) would be treated, and the effluent discharged. All discharges would be routinely monitored to comply with NPDES permit limits and other site-specific discharge requirements. All potential locations are located outside both the 100- and 500-year floodplains.

No 100- or 500-year floodplain assessments have been conducted for the new collocated facilities. This would be developed during the siting process.

Groundwater. No groundwater would be used for any project-related water requirements, and no wastewater would be discharged directly to groundwater. Therefore, neither groundwater quality nor availability would be affected. In addition, because there would be no direct discharges to the environment, limestone deposits located beneath the plant would not be a factor for future groundwater contamination.

Construct New Plutonium and Highly Enriched Uranium Storage Facilities

[Text deleted.]

The impacts associated with the new Pu and HEU storage facilities are the same as those discussed above, with the following exceptions. The water requirements for construction and operation of this option are greater than those described for the new consolidated Pu storage facility and upgrade of Y-12 Plant and are approximately 104.7 million l/yr (27.7 million gal/yr) and 360 million l/yr (95.1 million gal/yr), respectively. These additional requirements represent 0.7- and 2.4-percent increases, respectively, in the projected annual surface water withdrawals from the Clinch River. These increases, however, represent much less than 1 percent of the average flow of the Clinch River and would cause minimal impacts.

Sanitary wastewater quantities generated during construction and operation of this option are approximately 13.0 million l/yr (3.4 million gal/yr) and 172 million l/yr (45.4 million gal/yr), respectively. These additional effluents represent 0.6- and 7.6-percent increases, respectively, in discharge and 0.03- and 0.4-percent, respectively, of the average flow of East Fork Poplar Creek. No impacts are expected.

As discussed in Section 3.6.4, DOE is currently involved with remediation of East Fork Poplar Creek under CERCLA. Any discharges that may influence and potentially impact East Fork Poplar Creek would require engineering design measures to avoid interference with the goals of the remediation effort. Since groundwater would not be used for this option, no impacts to groundwater availability or quality would be expected.

Subalternative Not Including Strategic Reserve and Weapons Research and Development Materials

Water resource impacts during construction and operation for this subalternative are expected to be slightly less than those for the No Action Alternative, the Upgrade Alternative, and the Collocation Alternative because of the reduction in the amount of material. [Text deleted.]

Phaseout

If the current HEU storage mission at ORR was phased out, surface water withdrawals from the Clinch River and nonhazardous wastewater discharge to the Clinch River would decrease by negligible quantities (0.29 million l/yr [0.077 million gal/yr]). No noticeable impacts would occur or be alleviated due to these decreases.

[Text deleted.]

4.2.5.5 Geology and Soils

Construction and operation of the alternatives at ORR would have no impact on the geological resources identified. A low seismic risk exists, but would be considered in the design of the proposed alternatives. The existing seismic risk does not preclude the safe construction and operation of the proposed alternative facilities. The facilities would be designed for earthquake-generated ground acceleration in accordance with DOE O 420.1, *Facility Safety*. Because there are no known capable faults at ORR, ground rupture as a result of an earthquake during the life of the facility is minimal; ground shaking is more likely to occur. Intensities of more than VI on the MMI scale are not likely at ORR. Ground shaking could affect the integrity of inadequately designed (older) or nonreinforced structures but would not affect newly designed or modified facilities. Human health effects from accidents initiated by natural phenomena (for example, earthquakes) are discussed in Section 4.2.5.9. Volcanic activity is improbable during the life of an alternative and is not anticipated to affect the construction and operation of the alternatives. It is also unlikely that landslides or other nontectonic events would affect the proposed alternatives. Slopes and underlying foundation materials are generally stable. Sinkholes are present in the Knox Dolomite, however the Knox Dolomite is not present in Bear Creek Valley or proposed alternative areas. Properties and conditions of soils underlying ORR typically have no limitations on construction. No economically viable geological resources are known to be present at ORR.

Impacts to the geological and soil resources occur during, or as a result of, ground-disturbing construction activities. Construction of the alternatives may involve ground-disturbing activities that could affect the soil resources. The amount of land disturbed is specified below for each alternative. Effects to the soil resource would depend on the specific soil units in the disturbed area, the extent of land-disturbing activities, and the amount of soil disturbed. Within ORR, the soil erosion potential is directly related to the amount of land disturbed because soil and climatic conditions are similar throughout the site. Control measures would be employed to minimize soil erosion.

No Action Alternative

[Text deleted.] Under the No Action Alternative, DOE would continue current and ongoing activities at ORR. There would be no ground-disturbing activities beyond those associated with existing and future site improvements. Because no new construction and the associated ground disturbance for potential soil erosion would occur, the No Action Alternative would have no effect on geologic or soil resources at the site.

Upgrade Alternative

Preferred Alternative: Modify Existing Y-12 Plant for Continued Highly Enriched Uranium Storage

Because no new ground-breaking construction activities are planned under this alternative, no construction or operational effects to geologic or soil resources are anticipated.

Collocation Alternative

Construct New Plutonium Storage Facility; Maintain Existing Highly Enriched Uranium Storage Facilities at Y-12 Plant

Construction of the new Pu storage facility will occur on undisturbed land, as described in Section 4.2.5.1. During construction approximately 58.5 ha (144 acres) would be disturbed. Soil disturbance would occur primarily from ground-disturbing construction activities (foundation preparation) and activities associated with building construction laydown areas that can expose the soil profile and lead to a possible increase in erosion as a result of wind and water action. Soil losses would depend on the frequency and severity of storms; wind velocities (increased wind velocities and duration can increase soil erosion potential); and the size, location, and duration of ground-disturbing activities with respect to local drainage and wind patterns.

Net soil disturbance during operations would be considerably less than during construction because areas temporarily used for construction laydown would be restored. Although stormwater runoff and wind action could occur occasionally during operations, they are anticipated to be minimal. [Text deleted.]

Construct New Plutonium Storage Facility and Modify Existing Highly Enriched Uranium Storage Facilities at Y-12 Plant

No apparent direct or indirect effects on the geologic resources are anticipated, because neither facility construction and operational activities nor site infrastructure improvements will restrict access to potential geologic resources.

Construction and operation effects on geology and soil resources for this option would be similar to those described for the new Pu storage facility and maintain existing HEU storage option. [Text deleted.] Construction of the new Pu storage facility for this subalternative would occur on undeveloped land, as described in Section 4.2.5.1. Approximately 58.5 ha (144 acres) would be disturbed for the new facilities, affecting the soil profile and leading to a possible temporary increase in erosion as a result of stormwater runoff and wind action. Soil impacts during operation are expected to be minimal.

Construct New Plutonium and Highly Enriched Uranium Storage Facilities

No apparent direct or indirect effects on the geologic resources are anticipated, because neither facility construction and operational activities nor site infrastructure improvements will restrict access to potential geologic resources.

Construction and operation effects on geology and soil resources for this option would be similar to those described for the new Pu storage facility and maintain existing HEU storage option. Construction of these facilities would occur completely on undisturbed land, as described in Section 4.2.5.1. Additional soil impacts would be anticipated because this option has the greatest construction and operations land use. Approximately 89.5 ha (221 acres) would be disturbed for construction of the new facilities, affecting the soil profile and leading to a possible temporary increase in erosion as a result of stormwater runoff and wind action. Soil impacts during operation are expected to be minimal.

Subalternatives Not Including Strategic Reserve and Weapons Research and Development Materials

Excluding strategic reserve and weapons R&D materials would give almost the same effects to the geologic and soil resources for the No Action Alternative, the Upgrade Alternative, and the Collocation Alternative. By excluding these materials, the size of a facility would be similar, thus not changing the amount of land disturbed by construction activities. No effect to the geological resource is anticipated as a result of this subalternative.

Phaseout

The phaseout of storage capacity would have no apparent effects on the geology resources. However, phaseout could result in beneficial effects in the soil of the area. Hazardous, radioactive, and mixed waste sources would be eliminated from the area, thus decreasing the potential for future soil contamination.

[Text deleted.]

4.2.5.6 Biological Resources

No Action Alternative

Under No Action, the HEU storage mission described in Section 2.2.5 would continue at ORR. These activities would result in no appreciable change to current conditions of biological resources at ORR as described in Section 3.6.6.

Upgrade Alternative

Preferred Alternative: Modify Existing Y-12 Plant for Continued Highly Enriched Uranium Storage

Upgrading existing HEU storage facilities at Y-12 would cause minimal disturbance to biological resources. This is the case since upgrades would involve existing structures and would take place within an area that is currently disturbed by existing facilities and operations. Noise associated with construction could cause some temporary disturbance to wildlife, but this impact would be minimal since animals living adjacent to Y-12 have already adapted to its presence. Water withdrawal and wastewater discharge would be through existing structures and would involve relatively minor volumes, so wetlands and aquatic resources would not be affected. Discharges would not be expected to be large enough to affect resident populations of the Tennessee dace (deemed in need of management by the State) in Bear Creek.

Collocation Alternative

Construct New Plutonium Storage Facility; Maintain Existing Highly Enriched Uranium Storage Facilities at Y-12 Plant

Under this alternative, consolidated Pu materials would be stored in a new storage facility at ORR. Impacts to terrestrial resources, wetlands, aquatic resources, and threatened and endangered species are described below.

Terrestrial Resources. Construction and operation for the consolidated Pu storage facility at ORR would result in the disturbance of 58.5 ha (144 acres) or about 0.4 percent of ORR. This acreage includes areas on which the facility would be constructed, as well as areas that would be revegetated following construction. Vegetation within the area to be developed would be destroyed during land clearing. Vegetation cover within the proposed site is predominantly oak-hickory forest or pine and pine-hardwood forest (Figure 3.6.6-1). While both types would be affected by construction, it is likely that a greater area of pine and pine-hardwood forests would be removed. This type of forest is more heavily concentrated in valleys, which is where most of the development would occur. Oak-hickory forests are typically found on ridges. Both forest types are common throughout ORR and within the region.

Construction of the proposed facilities would effect some animal populations. Less-mobile animals within the proposed project area, such as amphibians, reptiles, and small mammals, would not be expected to survive. Construction activities and noise would cause larger mammals and birds in the construction area and adjacent areas to move to similar habitat nearby. If the area to which they moved was below its carrying capacity, these animals would be expected to survive. However, if the area was already supporting the maximum number of individuals, the additional animals would compete for limited resources, which could lead to habitat degradation and eventual loss of the excess population. Nests and young animals living within the proposed site may not survive. The site would be surveyed as necessary for the nests of migrating birds prior to construction. Upon completion of construction, revegetated areas would be of minimal value to most wildlife since they would be maintained as landscaped areas.

Activities associated with operation, such as noise and human activity, could affect wildlife living immediately adjacent to the proposed facility. These disturbances may cause some species to move from the area. Disturbance to wildlife living adjacent to the facility would be minimized by preventing workers from entering undisturbed areas. Salt drift generated by mechanical draft cooling systems would be minimal, and no impacts to natural vegetation are expected.

Wetlands. Because the majority of the area in which the proposed facility would be located is upland, it is expected that direct impacts to wetlands could be avoided. Implementation of erosion and sediment control measures would control secondary impacts. Since an existing intake structure would be used during both construction and operation, it would not be necessary to disturb wetlands along the Clinch River. However, a new discharge structure could be required on East Fork Poplar Creek. Depending on its location, this structure could displace some wetlands along the creek. Any potential impacts to wetlands resulting from construction activities would be mitigated in accordance with DOE policy set forth in 10 CFR 1022 and the requirements of a COE permit.

During construction and operation, discharges would be directed to East Fork Poplar Creek. Discharges would have a minimal impact on the flow of the stream and are not expected to affect associated wetlands. All wastewater discharges would be treated as necessary to meet NPDES permit requirements.

Aquatic Resources. Construction and operation of the consolidated storage facility could cause water quality changes (primarily sediment loading and resulting turbidity) to Bear Creek, Grassy Creek, or Ish Creek as a result of soil erosion. Soil erosion and sediment control measures would be implemented to control erosion. Water requirements during both construction and operation would be met by existing site sources. Since a new intake structure would not be required, direct disturbance to aquatic resources in the Clinch River would not occur. Water withdrawal during construction and operation would represent a very small percentage of the Clinch River's average flow and would have little effect on the flow of the river. Flow-related impacts to aquatic resources from increases in impingement and entrainment would be minimal and would be unlikely to affect fish populations in the river.

During construction and operation, wastewater would be discharged to East Fork Poplar Creek. This could require the construction of a new discharge structure that would temporarily disturb aquatic habitat in the vicinity of the outfall. The small volume of wastewater discharged to the stream would not be expected to affect aquatic resources during either construction or operation. In addition, all wastewater would be treated as necessary.

Threatened and Endangered Species. It is unlikely that federally listed threatened and endangered species would be affected by construction of the consolidated storage facilities. [Text deleted.] Land-clearing activities may destroy State-protected plant species found within or adjacent to disturbed portions of the proposed site including pink lady's-slippers, fen orchid, tubercled rein-orchid, American ginseng, purple fringeless orchid, Canada lily, and golden seal. The Tennessee dace is sensitive to siltation and actively seeks clean gravel for spawning. An increase in amount or duration of sediment runoff to Ish Creek or Bear Creek during facility construction could affect this fish species. Preactivity surveys would be conducted, as appropriate, prior to construction to determine the presence of special status species in the area to be disturbed. Consultation with USFWS and State agencies would be conducted at the site-specific level, as appropriate. No additional impacts are expected during operation of the facility. [Text deleted.]

Construct New Plutonium Storage Facility and Modify Existing Highly Enriched Uranium Storage Facilities at Y-12 Plant

Impacts resulting from constructing and operating a new consolidated Pu storage facility and upgrading Y-12 would be similar to those discussed above for the new consolidated Pu storage facility. This is the case since upgrading Y-12 would not disturb any additional land area.

Construct New Plutonium and Highly Enriched Uranium Storage Facilities

Under this alternative, consolidated Pu materials would be stored with HEU inventories in a new collocated storage facility(s) at ORR. Construction and operation of collocated storage facilities at ORR would have similar, but somewhat greater, effects on biological resources as those described for the new consolidated storage facility only. Construction of the collocated storage alternative would disturb 89.5 ha (221 acres) of habitat.

Subalternative Not Including Strategic Reserve and Weapons Research and Development Materials

The exclusion of strategic reserve and weapons R&D materials would have almost the same effects as the other facilities. The size of the facility would be similar, and would not reduce the area of disturbed habitat or lessen the potential impacts to biological resources for the No Action Alternative, the Upgrade Alternative, the Consolidation Alternative, and the Collocation Alternative. [Text deleted.]

Phaseout

The phaseout of HEU storage facilities at ORR is not expected to affect biological resources although short-term increased human activity could temporarily disturb some wildlife species in the vicinity of the site.

4.2.5.7 Cultural and Paleontological Resources

No Action Alternative

Under this alternative, DOE would continue the existing and planned missions at ORR. This includes the continued storage of HEU material at Y-12 in stabilized form pursuant to DNFSB Recommendation 94-1. Any impacts to cultural or paleontological resources from these missions would be independent of the proposed action and would be addressed through separate NHPA, *American Indian Religious Freedom Act*, and *Native American Graves Protection and Repatriation Act* regulatory compliance procedures. In May 1994, a Programmatic Agreement was executed among the DOE Oak Ridge Operations Office, the Tennessee SHPO, and the Advisory Council on Historic Preservation regarding the management of historic and cultural properties at ORR. This agreement was administered to satisfy DOE's responsibilities regarding Sections 106 and 110 of the NHPA and requires DOE to develop a cultural resources management plan for ORR and conduct cultural resources surveys as required.

Upgrade Alternative

Preferred Alternative: Modify Existing Y-12 Plant for Continued Highly Enriched Uranium Storage

Under this alternative, existing buildings would be modified at Y-12 to accommodate ORR nonsurplus HEU material. No additional land would be required for construction or operation of the facilities. New construction and building modification pose the greatest threat to prehistoric, historic, and paleontological resources. Operation would not have a direct effect on these resources. Impacts to archaeological and paleontological resources are not likely as a result of this alternative because it would involve the upgrade of five existing facilities (9212 E-Wing Vault, 9204-2 First Floor, 9202E First Floor, 9215, and 9998). Four of these facilities are NRHP-eligible historic resources based on their association with World War II. They would be part of a proposed Y-12 Plant National Register Historic District. No Native American resources have been identified at Y-12. Consequently, no impacts to Native American resources are expected to result under this alternative.

Collocation Alternative

Construct New Plutonium Storage Facility; Maintain Existing Highly Enriched Uranium Storage Facilities at Y-12 Plant

Under this alternative, a new facility would be constructed east of K-25 and west of ORNL to accommodate all Pu material within the scope of this PEIS and existing facilities at Y-12 would continue to store ORR nonsurplus HEU material. Land to be disturbed during the construction of this facility would total 58.5 ha (144 acres) and the total operational land disturbance would be 56 ha (138 acres). A reduced-access buffer zone would exist around the facility. [Text deleted.] Construction and operation can have an impact on Native American resources by affecting traditional plant and animal communities through construction and by reducing access to traditional use areas during operation. Paleontological resources can also be affected through new construction, however, those known to occur at ORR are relatively common fossils with low research potential.

Survey work would be conducted prior to construction to identify any cultural resources in the area. A portion of this area on both sides of Bear Creek Road was surveyed prior to construction of the proposed Exxon Nuclear Facility, which was never built (OR UTN 1975a:iii). Some prehistoric sites were identified near the Clinch River, and the potential for sites along the smaller creeks exists. In addition, remains of a number of early 20th-century frame houses and mid-to-late 19th-century log houses and outbuildings are located within the project area. Prehistoric site types that are known to occur at ORR include remains of prehistoric villages, burial grounds, quarries and lithic workshops, and shell scatters. One NRHP-eligible prehistoric site has been identified near K-25, on the Clinch River. Historic resources may include standing structures, as well as remains of dwellings, road traces, cemeteries, and trash scatters. Resources such as these may occur in the area to be

disturbed. Some Native American resources may be affected by construction and operation of the facility. These resources, should any exist, would be identified through consultation with the potentially affected tribes.

Construct New Plutonium Storage Facility and Modify Existing Highly Enriched Uranium Storage Facilities at Y-12 Plant

This alternative involves upgrades to facilities at Y-12 and the construction of a new Pu storage facility east of K-25 and west of ORNL. Land disturbance during construction would total 58.5 ha (144 acres). The operational land requirements would be 56 ha (138 acres). Impacts to cultural and paleontological resources at Y-12 would be similar to those described under the previously discussed Collocation Alternative, including creation of a 1.6-km (1-mi) buffer zone.

Construct New Plutonium and Highly Enriched Uranium Storage Facilities

This option involves the construction of a new facility east of K-25 and west of ORNL to accommodate all Pu and HEU material within the scope of this PEIS. Consequently, the land requirements during construction and operation are greater than those discussed under the previous collocation options. Construction of this facility would disturb 89.5 ha (221 acres) of land. The operational requirement would be 87 ha (215 acres). A reduced-access buffer zone would be created around the facility. Based on location and land requirements, the potential for impacts to cultural resources under this option would be similar to those described under the previous options. A slightly larger land requirement results in a slightly greater potential for impacts.

Subalternative Not Including Strategic Reserve and Weapons Research and Development Materials

Under this subalternative, facility and other resource requirements will be almost the same as the No Action Alternative, the Upgrade Alternative, and the Collocation Alternative. Therefore, impacts to cultural and paleontological resources would be equal to those previously discussed. [Text deleted.]

Phaseout

No acreage is expected to be disturbed during phaseout. Consequently, no impacts to archaeological sites or paleontological remains are anticipated. Some NRHP-eligible historic structures may be affected by this alternative, depending on the tasks involved with phaseout. No resources of Native American importance have been identified at Y-12, so impacts to these resources are not expected.

4.2.5.8 Socioeconomics

No Action Alternative

Regional Economy Characteristics. Total employment in the REA is projected to increase by approximately 1 percent annually between 1995 and 2000, reaching about 488,100 in the latter year. Long-range projections indicate slower growth after the year 2000, when employment would increase by less than 1 percent annually and reach approximately 665,000 in 2040. Unemployment in the REA was 4.9 percent in 1994 and is expected to remain at this level into the near future. Per capita income is projected to increase from approximately \$18,190 in 1995 to \$26,368 in 2040. Projections for the No Action Alternative are presented in Table L.1-46.

Population and Housing. Population in the ROI is projected to increase from approximately 518,600 in 1995 to 751,800 by 2040. The total number of available housing units in the ROI is projected to increase from about 214,700 in 1995 to 311,200 in 2040. Population and housing projections for the No Action Alternative are presented in Tables L.1-47 and L.1-48, respectively.

Community Services. Education, public safety, and health care characteristics are used to assess the level of community services in the ORR ROI. School enrollments are projected to increase from about 83,340 students in 1995 to 120,810 students by 2040. The current student-to-teacher ratio is 16.2:1. To maintain this level of service, the number of teachers in the ROI would need to increase from approximately 5,132 in 1995 to 7,442 in 2040. These projections are presented in Tables L.1-49 and L.1-50.

The projected numbers of sworn police officers and firefighters serving the ROI communities over the period 1995 to 2040 are shown in Tables L.1-51 and L.1-52, respectively. Under No Action, the number of sworn police officers is projected to increase from approximately 897 in 1995 to 1,299 in 2040 to maintain the current service level of 1.7 sworn officers per 1,000 persons. The number of firefighters in the ROI would need to increase from about 1,120 in 1995 to 1,624 in 2040 to maintain the present service level of 2.2 firefighters per 1,000 persons.

Hospital occupancy rates are based on current capacity. These rates and the estimated number of physicians serving the ROI population between 1995 and 2040 are presented in Tables L.1-53 and L.1-54, respectively. Hospital occupancy rates are projected to increase from approximately 65 percent in 1995 to about 93 percent in 2040. To maintain the current physician-to-population ratio of 2.5 physicians per 1,000 persons, the total number of physicians in the ROI would need to increase from approximately 1,322 in 1995 to 1,917 in 2040.

Local Transportation. Any increases in traffic would be due to projected growth in the area unrelated to DOE activity. [Text deleted.]

Upgrade Alternative

Preferred Alternative: Modify Existing Y-12 Plant for Continued Highly Enriched Uranium Storage

Of all the long-term storage alternatives being considered at ORR, the upgrade existing HEU storage facilities option would create the smallest socioeconomic changes within the region. This alternative would generate a total of 132 jobs (66 direct and 66 indirect) during construction and a total of 395 jobs (111 direct and 284 indirect) during operation. In both phases, there would be sufficient available labor in the REA to fill both direct and indirect jobs created from this alternative. Therefore, no workers would in-migrate to the REA and no change to the REA population would result beyond No Action projections.

Regional Economy Characteristics. Due to the small number of workers required during construction and operation phases, the regional economy would remain virtually unchanged compared to No Action projections. Total employment would increase by much less than 1 percent during construction and operation of the facilities. Unemployment would decrease from 4.9 to 4.8 percent during construction and operation. Per capita income would also remain virtually unchanged, increasing by much less than 1 percent over the No Action alternative (Socio 1996a).

Population and Housing, Community Services, and Local Transportation. All newly created employment would be filled by the resident labor force. Therefore, there would be no change to the region's population beyond the No Action level. Accordingly, minimal impacts to the housing sector, community services, or local transportation would occur as a result of the construction and operation of these facilities.

Collocation Alternative

Construct New Plutonium Storage Facility; Maintain Existing Highly Enriched Uranium Storage Facilities at Y-12 Plant

To consolidate storage of Pu currently stored at multiple DOE sites, a new storage facility would need to be constructed at ORR. Existing buildings at Y-12 would continue to store ORR nonsurplus HEU material. Workers would in-migrate to fill a portion of the direct jobs created during construction and operation of this facility.

Regional Economy Characteristics. Construction would generate a total of 2,226 jobs (1,115 direct and 1,111 indirect). Operation of the facility would generate a total of 1,575 jobs (443 direct and 1,132 indirect). Total employment would increase by less than 1 percent over No Action projections during both construction and operation. Unemployment would decrease to 4.4 percent during construction and 4.6 percent during operation. Per capita income would increase by much less than 1 percent during both phases (Socio 1996a).

Population and Housing. The in-migration of workers during the construction and operation periods would increase the ROI population by much less than 1 percent over No Action projections. The larger increase would occur during construction. Some new housing may be needed. However, expected vacancies and historic housing construction rates indicate that housing would be available to accommodate the population growth (Socio 1996a).

Community Services. The ROI population growth would slightly increase the demand for some community services. Worker in-migration would lead to an increase in ROI school enrollments by about 40 students during construction and 2 students during operation. To maintain the No Action student-to-teacher ratio of 16.2:1, the number of teachers would have to increase by three during the construction period. Operation would not require any additional teachers (Socio 1996a). This additional need for teachers would be distributed over the various jurisdictions in the ROI, so the effect on any single school district would be minimal.

To maintain No Action level of service, no police officers and one firefighter would need to be hired during the construction period. No additional police officers or firefighters would be required to maintain No Action service levels during operation (Socio 1996a).

The small population increase would have a negligible effect on health services, increasing hospital occupancy by much less than 1 percent during construction and operation. The number of physicians in the ROI would need to increase by only one during construction to maintain the No Action service level. No additional physicians would be needed during operation (Socio 1996a).

Local Transportation. A total of 2,141 and 851 vehicle trips per day would be generated during the construction and operation phases, respectively. During construction, there would be a noticeable increase in the

volume-to-capacity ratio of Tennessee State Route 62, between Tennessee State Route 95 and Tennessee State Route 170. The road segment however, would continue to operate at level of service F, the lowest level of service. Traffic generated from facility operations would not affect the level of service on the road segments analyzed (Socio 1996a).

Construct New Plutonium Storage Facility and Modify Existing Highly Enriched Uranium Storage Facilities at Y-12 Plant

To consolidate storage of Pu currently stored at multiple DOE sites and improve HEU storage, a new Pu storage facility would need to be constructed and existing HEU facilities upgraded at ORR. Workers would in-migrate to fill a portion of the direct jobs created during construction and operation of these facilities.

Regional Economy Characteristics. Construction would generate a total of 2,316 jobs (1,155 direct and 1,161 indirect). Operation would generate a total of 1,969 jobs (554 direct and 1,415 indirect). Total employment would increase by less than 1 percent over No Action projections during both construction and operation. Unemployment would decrease from 4.9 percent to 4.4 percent during construction and 4.5 percent during operation. Per capita income would increase by less than 1 percent during both phases (Socio 1996a).

Population and Housing. The in-migration of workers during the construction and operation periods would increase the ROI population by much less than 1 percent over No Action projections. The larger increase would occur during construction. Some new housing may be needed. However, expected vacancies and historic housing construction rates indicate that housing would be available to accommodate the population increase (Socio 1996a).

Community Services. The additional population would slightly increase the demand for some community services. Worker in-migration would lead to an increase in ROI school enrollments by about 62 students during construction and 8 students during operation. To maintain the No Action student-to-teacher ratio of 16.2:1, the number of teachers would have to increase by four during the construction period. Operation would not require any additional teachers (Socio 1996a). This additional need for teachers would be distributed over the various jurisdictions in the ROI, so the effect on any single school district would be minimal.

To maintain No Action levels of service, two police officers and three firefighters would need to be hired during the construction period. No additional police officers or firefighters would be required to maintain No Action service levels during operation (Socio 1996a).

The small population increase would have a negligible effect on health services, increasing hospital occupancy by much less than 1 percent during construction and operation. The number of physicians in the ROI would need to increase by three during construction to maintain the No Action service level. No additional physicians would be needed during operation (Socio 1996a).

Local Transportation. A total of 2,337 and 1,064 vehicle trips per day would be generated during the construction and operation phases, respectively. During construction there would be a noticeable increase in the volume-to-capacity ratio of Tennessee State Route 62, between Tennessee State Route 95 and Tennessee State Route 170. The road segment however, would continue to operate at level of service F, the lowest level of service. Traffic generated from facility operations would not affect the level of service on the local road segments analyzed (Socio 1996a).

Construct New Plutonium and Highly Enriched Uranium Storage Facilities

To consolidate storage of Pu and HEU currently stored at multiple DOE sites, new storage facilities would need to be constructed at ORR. Workers would in-migrate to fill a portion of the direct jobs created during construction and operation of these facilities.

Regional Economy Characteristics. Construction would generate a total of 3,063 jobs (1,534 direct and 1,529 indirect). Operation would generate a total of 2,012 jobs (566 direct and 1,446 indirect). Total employment would increase by less than 1 percent over No Action projections during both construction and operation. Unemployment would decrease to 4.4 percent during construction and 4.5 percent during operation. Per capita income would increase by less than 1 percent during both phases (Socio 1996a).

Population and Housing. The in-migration of workers during the construction and operation periods would increase the ROI population by less than 1 percent over No Action projections. The larger increase would occur during construction. Some new housing may be needed. However, expected vacancies and historic housing construction rates indicate that housing would be available to accommodate the population growth (Socio 1996a).

Community Services. The ROI population growth would slightly increase the demand for some community services. Worker in-migration would lead to an increase in ROI school enrollments by about 223 students during construction and 6 students during operation. To maintain the No Action student-to-teacher ratio of 16.2:1, the number of teachers would have to increase by 14 during the construction period. Operation would not require any additional teachers (Socio 1996a). This additional need for teachers would be distributed over the various jurisdictions in the ROI, so the effect on any single school district would be minimal.

To maintain No Action level of service, only one police officer and firefighter would need to be hired during the construction period. No additional police officers or firefighters would be required to maintain No Action service levels during operation (Socio 1996a).

The small population increase would have a negligible effect on health services, increasing hospital occupancy by much less than 1 percent during construction and operation. The number of physicians in the ROI would need to increase by only one during construction to maintain the No Action service level. No additional physicians would be needed during operation (Socio 1996a).

Local Transportation. A total of 2,945 and 1,087 vehicle trips per day would be generated during construction and operation, respectively. During construction there would be a noticeable increase in the volume-to-capacity ratio of Tennessee State Route 62, between Tennessee State Route 95 and Tennessee State Route 170. The road segment however, would continue to operate at level of service F, the lowest level of service. Traffic generated from facility operations would not affect the level of service on the road segments analyzed (Socio 1996a).

Subalternative Not Including Strategic Reserve and Weapons Research and Development Materials

The requirements for each storage option considered would decrease slightly if strategic reserve and weapons R&D materials were not included for storage at ORR. This should result in a decrease in the number of required operation employees for each of the considered alternatives. Therefore, socioeconomic effects on the REA/ROI for the storage alternatives with no strategic reserve and weapons R&D materials should be equal to, or somewhat less than, the No Action Alternative, the Upgrade Alternative, and the Collocation Alternative. [Text deleted.]

Phaseout

Phasing out HEU storage at ORR would result in the loss of 476 total (direct and indirect) jobs in the REA. Should all personnel be phased out at the same time, unemployment would remain at the No Action estimate of 4.9 percent and per capita income would be reduced by much less than 1 percent (Socio 1996a).

Some displaced workers may out-migrate from the ROI to seek other employment opportunities. Under the bounding case (all unemployed workers and their families leaving the ROI at the same time), population would

decrease by less than 1 percent. Some of the projected ROI occupied housing units would likely become vacant as a result of population losses (Socio 1996a).

The out-migration of population during phaseout would slightly lessen the demand for community services. It is unlikely that communities would lower service levels unless decreased revenues made it necessary.

Region of influence school enrollments are projected to decrease by much less than 1 percent during the bounding case scenario for phaseout. The No Action student-to-teacher ratio of 16.2:1 could be maintained if the number of teachers does not decrease from predicted No Action levels by more than 13 (Socio 1996a).

During phaseout, the number of sworn police officers could not decrease from predicted No Action levels if the No Action service level of 1.7 officers per 1,000 persons were to be maintained. The number of firefighters could decrease by one before the No Action service level of 2.2 firefighters per 1,000 persons would be affected (Socio 1996a).

Projected hospital occupancy rates during the bounding case scenario for phaseout would be slightly lower than the No Action projections. The number of physicians in the ROI could decrease by three from predicted No Action levels before the No Action service level of 2.6 physicians per 1,000 persons would be affected (Socio 1996a).

Phaseout would result in the loss of 129 vehicle trips per day. There would be no significant effect to the local road network due to this activity (Socio 1996a).

4.2.5.9 Public and Occupational Health and Safety

The assessments of potential radiological and chemical impacts associated with the storage alternatives at ORR are presented in this section. Summaries of radiological impacts from normal operations are presented in Tables 4.2.5.9-1 and 4.2.5.9-2 for the public and workers, respectively. Impacts from hazardous chemicals are presented in Table 4.2.5.9-3. Summaries of impacts associated with postulated accidents are presented in Table 4.2.5.9-4. Detailed results are presented in Appendix M.

No Action Alternative

This section describes the radiological and hazardous chemical releases and their associated impacts resulting from normal operations involved with the current ORR sitewide missions, including interim storage of HEU. The impacts would be within applicable regulatory limits. For facility accidents, the risks and consequences are described in site safety documentation.

Normal Operation. The current mission at ORR, where HEU is in interim storage, is described in Section 3.6. The site has identified those facilities that will continue to operate under the No Action Alternative, including interim HEU storage facilities and others, if any, that will become operational by 2005. Based on that information, the radiological and chemical releases to the environment in 2005 and beyond (future operation) were developed and used in the impact assessments. The resulting doses and potential health effects to the public and workers at ORR are described below.

Radiological Impacts. The calculated annual dose to the average and maximally exposed member of the public from total site operation; the associated fatal cancer risks to these individuals from 50 years of operation; the dose to the population within 80 km (50 mi) from total site operation in the year 2030; and the projected number of fatal cancers in this population from 50 years of operation are presented in Table 4.2.5.9-1 under this alternative at ORR. The annual dose of 3.2 mrem to the MEI is within the radiological limits specified in NESHAPS (40 CFR 61, Subpart H) and DOE Order 5400.5. From 50 years of operation, the corresponding risk of fatal cancer to this individual would be 8.0×10^{-5} . This activity would be included in a program to ensure that doses to the public are ALARA. The annual dose of 34 person-rem to the population would be within the limit in proposed 10 CFR 834. The corresponding number of fatal cancers in this population from 50 years of operation would be 0.85. To put operational doses into perspective, comparisons with natural background radiation doses are included in the table. The doses and projected fatal cancers associated with the storage component of the No Action Alternative are included in Table 4.2.5.9-1. These are seen to be much lower than those from total site operations.

Under the No Action alternative shown in Table 4.2.5.9-2, the average annual dose to a noninvolved (No Action) site worker and the annual dose to the noninvolved (No Action) total site workforce would be 2.6 mrem and 44 person-rem, respectively. The associated risk of fatal cancer to the average worker from 50 years of total site operations would be 5.2×10^{-5} , and the projected number of fatal cancers among all workers from 50 years of total site operations would be 0.88.

Hazardous Chemical Impacts. Hazardous chemical impacts to the public resulting from the normal operation under No Action at ORR are presented in Table 4.2.5.9-3. The hazardous chemical impacts from current site operations were used to estimate the baseline site impacts for the various storage alternatives. The noncancer health effects expected and the risk of cancer due to the total chemical exposures were estimated for each site. Since the major releases due to normal operation at ORR would make up nearly all of the exposures to onsite workers and to the public in adjacent communities, contributions to the hazardous chemical concentrations from all other sources, for example, industrial operations, are considered negligible for purposes of risk calculations.

Table 4.2.5.9–2. Potential Radiological Impacts to Workers During Normal Operation at Oak Ridge Reservation—Storage Alternatives

Receptor	Upgrade	Collocation ^a
Involved Workforce^b		
Average worker dose (mrem/yr) ^c	28	264
50-year risk of fatal cancer	5.6×10^{-4}	5.3×10^{-3}
Total dose (person-rem/yr)	3	25
50-year fatal cancers	0.060	0.50
Noninvolved Workforce^d		
Average worker dose (mrem/yr) ^c	2.6	2.6
50-year risk of fatal cancer	5.2×10^{-5}	5.2×10^{-5}
Total dose (person-rem/yr)	44	44
50-year fatal cancers	0.88	0.88
Total Site Workforce^e		
Dose (person-rem/yr)	47	69
50-year fatal cancers	0.94	1.4

^a The impacts are assumed to be the same for each of the three collocation storage options (refer to text).

^b The involved worker is associated with operations of the proposed action. The maximum dose to the involved worker would be kept below 500 mrem per year. Based on a review of worker doses associated with similar operations (Section M.2.3.2), an average worker dose of 28 mrem per year was assumed. However, an effective ALARA program will ensure that the exposure will be reduced to that level which is as low as reasonably achievable. The number of involved badged workers for the upgrade and collocation alternatives would be 111 and 95, respectively.

^c The radiological limit for an individual worker is 5,000 mrem/year (10 CFR 835). However, DOE has also established an administrative control level of 2,000 mrem per year (DOE 1992t); the site must make reasonable attempts to maintain worker doses below this level.

^d The noninvolved worker is onsite but not associated with operations of the proposed action. The projected number of noninvolved badged workers in 2005, is 17,200. The Noninvolved Workforce is equivalent to the No Action workforce.

^e The impact to the total site workforce is the summation of the involved worker impact and the noninvolved worker impact.

[Text deleted.]

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The HI to the MEI of the public at ORR resulting from normal operation under the No Action Alternative is 4.0×10^{-2} , and the cancer risk is zero (because no carcinogens are introduced). The HI to the onsite worker is 0.15, and the cancer risk is zero (because no carcinogens are introduced).

Facility Accidents. Under the No Action Alternative, uranium would continue to be stored at the ORR site in existing facilities. These facilities currently operate in accordance with DOE safety orders which ensure that the risk to the public of prompt fatalities due to accidents or cancer fatalities due to operations will be minimized. The safety to workers and the public from accidents at existing facilities is also controlled by Technical Safety Requirements specified in detail in SARs or a Basis for Interim Operations document prepared and maintained specifically for a facility or process within a facility. Under these controls, any change in approved operations or to facilities would cause a halt in operations until it can be established that worker and public safety has not been compromised.

Upgrade Alternative

[Text deleted.]

Preferred Alternative: Modify Existing Y-12 Plant for Continued Highly Enriched Uranium Storage

This section describes the radiological and hazardous chemical releases and their associated impacts resulting from either normal operation or accidents involved with upgraded existing HEU storage facilities at ORR. The section describes the impacts from normal facility operations at ORR, then impacts of facility accidents.

During normal operation at ORR, the operation of the upgraded Y-12 Plant would result in impacts that are within applicable regulatory limits.

Normal Operation. There would be no radiological releases during the upgrading of existing storage facilities at ORR. Construction worker exposures to material potentially contaminated with radioactivity (for example, from construction activities involved with existing contaminated soil) would be limited to assure that doses are maintained ALARA. Toward this end, construction workers would be monitored as appropriate. Limited hazardous chemical releases are anticipated as a result of the construction activities. However, concentrations would be within the regulated exposure limits. During normal operation, there would be both radiological and hazardous chemical releases to the environment and also direct exposures. The resulting doses and potential health effects to the public and workers at ORR are described below.

Radiological Impacts. Doses to the public from upgraded storage would be slightly less than for storage under No Action, as shown in Table 4.2.5.9-1. This is because the upgraded storage facility safety and design features would improve, although the quantity of stored material would be the same as for the No Action Alternative, the distance to the MEI and the public would not change appreciably, and the population density would not change. Therefore, the risks and numbers of fatal cancers among the public would remain essentially the same as under the No Action Alternative. [Text deleted.] Total site doses to the MEI and the public are expected to be similar because storage represents a small contribution to the total site.

The dose to the MEI from annual total site operations is within the radiological limits specified in NESHAPS (40 CFR 61, Subpart H) and DOE Order 5400.5, and would be 3.2 mrem. From 50 years of operations, the corresponding risk of fatal cancer to this individual would be 8.0×10^{-5} . These values are presented in Table 4.2.5.9-1. The impacts to the average member of the public would be less. This activity would be included in a program to ensure that doses to the public are ALARA. As a result of total site operations in the year 2030, the population dose would be within the limit in proposed 10 CFR 834 and would be 34 person-rem. The corresponding number of fatal cancers in this population from 50 years of total site operation would be 0.85.

Facility and total site doses to onsite workers from normal operations are given in Table 4.2.5.9-2. Included are involved workers directly associated with the upgraded Y-12 storage plant, workers who are not involved with this plant, and the entire workforce at ORR. All doses fall within regulatory limits and administrative control levels. The associated risks and numbers of fatal cancers among the different workers from 50 years of operation are included in the table. Dose to individual workers would be kept low by instituting badged monitoring and ALARA programs and also workers rotations. As a result of the implementation of these mitigation measures, the actual number of fatal cancers calculated would be lower for the operation of this facility.

Hazardous Chemical Impacts. Hazardous chemical impacts to the public and to the onsite worker resulting from the normal operations of the upgraded storage facilities at ORR are presented in Table 4.2.5.9-3. The impacts from all site operations, including the upgraded storage facilities are also included in this table. Total site impacts, which include the No Action impact plus the facility impacts, are provided. All analyses to support the values presented in this table are provided in Section M.3.

The HI to the MEI of the public is 8.6×10^{-5} , and the cancer risk would be zero (because no carcinogens are introduced) as a result of operation of the upgraded storage facilities, in the year 2030. The HI and cancer risk would remain constant over 50 years of operation, because exposures would be expected to remain the same. The total site operation, including the upgrade facility, would result in an HI of 4.0×10^{-2} and a cancer risk of zero (because no carcinogens are introduced) for the MEI in the year 2030. This would be expected to remain constant as a result of 50 years of operation.

The HI to the onsite worker would be 5.7×10^{-4} and the cancer risk would be zero as a result of operation of the upgraded storage facilities in the year 2030. The HI and cancer risk would remain constant over 50 years of operation because exposures would be expected to remain the same. The total site operation, including the

upgrade facility, would result in an HI of 0.15 and a cancer risk of zero for the MEI in the year 2030. This would be expected to remain constant as a result of 50 years of operation.

Facility Accidents. Under the Preferred Alternative at ORR, nonsurplus HEU and surplus HEU pending disposition would remain in storage at Y-12 in existing and upgraded storage facilities. Upgrades for HEU storage in Building 9212, the building used in the Y-12 EA accident analysis, would include structural modifications to numerous columns, knee braces, and cross braces to provide proper stiffness and load distribution as documented in *Natural Phenomena Upgrade of the Downsized/Consolidated Oak Ridge Uranium/Lithium Plant Facilities* (Y/EN-5080, 1994). Appendix G of the Y-12 EA contains a list of buildings and the modifications required to bring the buildings into conformance with the target performance goal that is equivalent to the structural response of new facilities. The modifications made to these facilities are expected to result in a reduction in risk of accidents to workers and the public for equivalent quantities of stored HEU. Modification to these facilities would ensure that long-term storage would be in accordance with DOE Orders, and that the risks to the public of prompt fatalities due to accidents and of latent cancer fatalities due to normal operations would be minimized. These structural modifications would reduce the risk from seismic initiators such as a beyond design basis earthquake scenario.

Buildings included in the upgrade for long-term storage at Y-12, as described in Section 2.3.1, would be evaluated by analyses employing methodologies outlined in DOE Order 5480.21, Unreviewed Safety Questions; DOE Order 5480.22, Technical Safety Requirements; and DOE Order 5480.23, Nuclear Safety Analysis Reports. Facilities and buildings within Y-12 that contain substantial quantities of enriched uranium have DOE-approved SARs that are currently undergoing review in an SAR Update Program to meet requirements of new DOE Orders (OR DOE 1994:E-3). The SAR Update Program would reflect the long-term storage upgrade at Y-12 in a Conceptual Design Report for these structural modifications as part of the Stockpile Management Restructuring Initiative that DOE is pursuing.

One of the natural phenomena initiators of accident scenarios analyzed (nuclear criticality, fire, and mechanical upset) in the Y-12 EA included a design basis accident earthquake. For the earthquake scenario, the present evaluation criterion for the design basis earthquake corresponds to a hazard exceedance frequency of 5×10^{-4} per year. The Y-12 long-term storage buildings would be upgraded to meet the performance goal for a moderate hazard facility of Performance Category 3 in DOE Order 5480.28, *Natural Phenomena Hazards Mitigation*. The Performance Category 3 facility poses a potential hazard to worker and public health and safety and to the environment because radioactive or toxic materials are present in significant quantities. Design considerations for this category are to limit facility damage so that hazardous materials can be controlled and confined, occupants are protected, and functioning of this facility is not interrupted. A performance goal for Performance Category 3 is a hazard exceedance frequency of 1×10^{-4} per year (DOE Order 5480.28). Meeting this performance goal would reduce the expected risk for the design basis accidents analyzed in the Y-12 EA for Building 9212 by approximately 80 percent, resulting in a latent cancer fatality risk of 5.1×10^{-7} to the MEI and 5.7×10^{-8} to a noninvolved worker, and potential latent cancer fatalities of 7.4×10^{-6} for the 80-km (50-mi) offsite population.

The HEU EIS describes the disposition of surplus HEU currently stored at ORR. As surplus HEU is removed for disposition, the quantity of material in storage would be reduced, and therefore fewer buildings would be needed for storage. As this a reduction in the storage footprint, the risk would be reduced accordingly. The combination of upgrading the buildings with structural modifications (as discussed above) and reducing the storage footprint as surplus HEU disposition continues are expected to result in overall reduction in the risk to the public and workers from facility accidents.

Involved workers, those that would work in the facilities associated with the proposed action, may be subject to injury and, in some cases, fatality as a result of potential accidents. The locations of workstations, number of workers, personnel protective features, engineered safety features, and other design details affect the extent of worker exposures to accidents. Certain accidents such as fires, explosions and criticality could cause fatalities to workers close to the accident. Prior to construction of a new modification of an existing facility, DOE Orders

require detailed safety analyses to assure that facility designs and operating procedures limit the number of workers in hazardous areas and minimize risk of injury or fatality in the event of an accident.

Collocation Alternative

[Text deleted.]

Construct New Plutonium Storage Facility; Maintain Existing Highly Enriched Uranium Storage Facilities at Y-12 Plant

Normal Operation. There would be no radiological releases during the construction of a new Pu storage facility at ORR. Construction worker exposures to materials potentially contaminated with radioactivity (for example, from construction activities involved with existing contaminated soil) would be limited to assure that doses are maintained ALARA. Toward this end, construction workers would be monitored as appropriate. Limited hazardous chemical releases are anticipated as a result of the construction activities. However, concentrations would be within the regulated exposure limits. During normal operation, there would be both radiological and hazardous chemical releases to the environment and also direct exposures. The resulting doses and potential health effects to the public and workers at ORR are described below.

Radiological Impacts. Since the storage of the HEU contributes negligibly to the offsite radiological impacts, this alternative would result in impacts to the public that would be virtually the same as those associated with storage in a new consolidated and collocated Pu and HEU storage facility (refer to Table 4.2.5.9-1 and the discussions of the new Pu and HEU storage facilities). Radiological impacts to workers would also be expected to be the same (refer to Table 4.2.5.9-2).

Hazardous Chemical Impacts. Impacts to the public and to the onsite worker resulting from the normal operations of the new consolidated Pu storage facility and existing HEU storage facility at Y-12 are the same, or less than, those impacts shown in Table 4.2.5.9-3 for the Collocation Alternative (construct new Pu facility and modify existing HEU facility). Total site impacts shown in the table are the sum of the impacts under No Action plus the impacts due to the additional consolidated storage facility and any incremental impacts from the modified facility over the existing HEU storage facilities at the Y-12 Plant.

Facility Accidents. A set of potential accidents have been postulated for collocation of Pu and HEU for which there may be releases of Pu or HEU that may affect onsite workers and the offsite population. Impacts of accidents that release both Pu and HEU are bounded by the impacts due to Pu exposure. The accident consequences and risks to a worker located 619 m (2,030 ft) from the accident release point, the maximum offsite individual located at the site boundary, and the population located within 80 km (50 mi) of the accident release point are summarized in Table 4.2.5.9-4. For the set of accidents analyzed, the maximum number of cancer fatalities in the population within 80 km (50 mi) would be 4.9 at ORR for the beyond design basis earthquake accident scenario with an estimated probability of 1.0×10^{-7} per year (that is, probability of severe earthquake occurring is estimated to be about 1.0×10^{-5} , once in 100,000 years, multiplied by a damage and release probability of 0.01). The corresponding 50-year facility lifetime risk from the same accident scenario for the population, maximum offsite individual, and worker at 619 m (2,030 ft), would be 2.5×10^{-5} , 2.0×10^{-7} , and 1.6×10^{-7} , respectively. The maximum population 50-year facility lifetime risk would be 0.017 (that is, one fatality in about 2,900 years) at ORR for the PCV penetration by corrosion accident scenario with a probability of 0.064 per year. The corresponding maximum offsite individual and worker 50-year facility lifetime risks would be 9.9×10^{-5} , and 7.9×10^{-5} , respectively. Section M.5 presents additional facility accident data and summary descriptions of the accident scenarios identified in Table 4.2.5.9-4.

Construct New Plutonium Storage Facility and Modify Existing Highly Enriched Uranium Storage Facilities at Y-12 Plant

Normal Operation. There would be no radiological releases during the construction of a new Pu storage facility and modification of the existing Y-12 Plant at ORR. Construction worker exposures to materials potentially contaminated with radioactivity would be limited to assure that doses are maintained ALARA. Toward this end, construction workers would be monitored as appropriate. Limited hazardous chemical releases are anticipated as a result of the construction activities. However, concentrations would be within the regulated exposure limits. During normal operation, there would be both radiological and hazardous chemical releases to the environment and also direct exposures. The resulting doses and potential health effects to the public and workers at ORR are described below.

Radiological Impacts. Because the storage of the HEU contributes negligibly to offsite radiological impacts, this alternative would also result in impacts to the public that would be virtually the same as those associated with storage in a new consolidated and collocated Pu and HEU storage facility (refer to Table 4.2.5.9-1 and the discussion of the new Pu and HEU storage facilities). Radiological impacts to workers would also be expected to be the same (refer to Table 4.2.5.9-2).

Hazardous Chemical Impacts. Hazardous chemical impacts to the public and to the onsite worker resulting from the normal operations of the new consolidated Pu storage facility and modified Y-12 Plant at ORR are presented in Table 4.2.5.9-3. The impacts from all site operations, including the consolidation of a Pu facility, are also included in this table. Total site impacts, which include the No Action impact plus the facility impacts are provided. All analyses to support the values presented in this table are provided in Section M.3.

The HI to the MEI of the public is 7.1×10^{-5} , and the cancer risk is 1.6×10^{-7} as a result of operation of the new consolidation of Pu facility in the year 2030. The HI and cancer risk would remain constant over 50 years of operation, because exposures would be expected to remain the same. The total site operation, including the consolidation of Pu facility, would result in an HI of 4.0×10^{-2} and a cancer risk of 1.6×10^{-7} for the MEI in the year 2030. This would be expected to remain constant as a result of 50 years of operation.

The HI to the onsite worker would be 8.1×10^{-4} , and the cancer risk is 1.3×10^{-5} as a result of operation of the new consolidation of Pu facility in the year 2030. The HI and cancer risk would remain constant over 50 years of operation, because exposures would be expected to remain the same. The total site operation, including the new facility, would result in an HI of 0.15 and a cancer risk of 1.30×10^{-5} for the onsite worker in the year 2030. This would be expected to remain constant as a result of 50 years of operation.

Facility Accidents. Under this alternative, the impacts of accidents are bounded by the impacts shown in Table 4.2.5.9-4 and are similar to those described in the construct new Pu storage facility; maintain existing HEU storage facilities at Y-12.

Involved workers, those that would work in the facilities associated with the proposed action, may be subject to injury and, in some cases, fatality as a result of potential accidents. The locations of workstations, number of workers, personnel protective features, engineered safety features, and other design details affect the extent of worker exposures to accidents. Certain accidents such as fires, explosions and criticality could cause fatalities to workers close to the accident. Prior to construction of a new modification of an existing facility, DOE Orders require detailed safety analyses to assure that facility designs and operating procedures limit the number of workers in hazardous areas and minimize risk of injury or fatality in the event of an accident.

Construct New Plutonium and Highly Enriched Uranium Storage Facilities

This section includes a description of radiological and hazardous chemical releases and their associated impacts resulting from either normal operation or accidents involved with the consolidation of Pu storage and collocation with HEU storage facilities at ORR. This storage would take place in a new consolidated Pu and HEU storage facility.

Normal operation of the new storage facility at ORR would result in impacts that are within applicable regulatory limits.

Normal Operation. There would be no radiological releases during the construction of a new Pu and HEU storage facility at ORR. Construction worker exposures to material potentially contaminated with radioactivity (for example, from construction activities involved with existing contaminated soil) would be limited to assure that doses are maintained ALARA. Toward this end, construction workers would be monitored as appropriate. Limited hazardous chemical releases are anticipated as a result of construction activities. However, concentrations would be within the regulated exposure limits. During normal operation, there would be both radiological and hazardous chemical releases to the environment and also direct in-plant exposures. The resulting doses and potential health effects to the public and workers are described below.

Radiological Impacts. Radiological impacts to the public resulting from the normal operation of the new Pu and HEU storage facility at ORR are presented in Table 4.2.5.9–1. The impacts from all site operations, including the new storage facility, are also given in the table. To put operational doses into perspective, comparisons with doses from natural background radiation are included in the table.

The dose to the MEI from annual storage facility operation would be 4.5×10^{-5} mrem. From 50 years of operation, the corresponding risk of fatal cancer to this individual would be 1.1×10^{-9} . The impacts to the average member of the public would be less. As a result of storage facility operation in the year 2030, the population dose would be 8.7×10^{-4} person-rem. The corresponding number of fatal cancers in this population from 50 years of operation would be 2.2×10^{-5} .

The dose to the MEI of the public from annual total site operations is within the radiological limits specified in NESHAPS (40 CFR 61, Subpart H) and DOE Order 5400.5, and would be 3.2 mrem. From 50 years of operation, the corresponding risk of fatal cancer to this individual would be 8.0×10^{-5} . The impacts to the average member of the public would be less. This activity would be included in a program to ensure that doses to the public are ALARA. As a result of total site operation in the year 2030, the population dose would be within the limit in proposed 10 CFR 834 and would be 34 person-rem. The corresponding number of fatal cancers in this population from 50 years of operation would be 0.85.

Facility and total site doses to onsite workers from normal operations are given in Table 4.2.5.9–2. Included are involved workers directly associated with the new storage facility, workers who are not involved with the storage facility, and the entire workforce at ORR. All doses fall within regulatory limits and administrative control levels. The associated risks and numbers of fatal cancers among the different workers from 50 years of operation are included in the table. Dose to individual workers would be kept low by instituting badged monitoring and ALARA programs and also workers rotations. As a result of the implementation of these mitigation measures, the actual number of fatal cancers calculated would be lower for the operation of this facility.

Hazardous Chemical Impacts. Hazardous chemical impacts to the public and to the onsite worker resulting from the normal operations of the new consolidation of Pu and collocation with HEU storage facilities at ORR are presented in Table 4.2.5.9–3. The impacts from all site operations, including the consolidation of Pu and

collocation with HEU storage facilities, are also included in this table. Total site impacts, which include the No Action impact plus the facility impacts, are provided. All analyses to support the values presented in this table are provided in Section M.3.

The HI to the MEI of the public is 1.5×10^{-4} , and the cancer risk is 1.6×10^{-7} as a result of operation of the consolidation of Pu and collocation with HEU storage facilities in the year 2030. The HI and cancer risk would remain constant over 50 years of operation, because exposures would be expected to remain the same. The total site operation, including the consolidation of Pu and collocation with HEU storage facilities, would result in an HI of 4.0×10^{-2} and a cancer risk of 1.6×10^{-7} for the MEI in the year 2030. This would be expected to remain constant as a result of 50 years of operation.

The HI to the onsite worker would be 1.3×10^{-3} and the cancer risk is 1.3×10^{-5} as a result of operation of the new consolidation of Pu and collocation with HEU storage facilities in the year 2030. The HI and cancer risk would remain constant over 50 years of operation, because exposures would be expected to remain the same. The total site operation, including the new facility, would result in an HI of 0.15 and a cancer risk of 1.3×10^{-5} for the onsite worker in the year 2030. This would be expected to remain constant as a result of 50 years of operation.

Facility Accidents. Under this alternative, the impacts of accidents are bounded by the impacts shown in Table 4.2.5.9–4 and are similar to those described in the construct new Pu storage facility; maintain existing HEU storage facilities at Y–12.

Involved workers, those that would work in the facilities associated with the proposed action, may be subject to injury and, in some cases, fatality as a result of potential accidents. The locations of workstations, number of workers, personnel protective features, engineered safety features, and other design details affect the extent of worker exposures to accidents. Certain accidents such as fires, explosions and criticality could cause fatalities to workers close to the accident. Prior to construction of a new modification of an existing facility, DOE Orders require detailed safety analyses to assure that facility designs and operating procedures limit the number of workers in hazardous areas and minimize risk of injury or fatality in the event of an accident.

Subalternative Not Including Strategic Reserve and Weapons Research and Development Materials

If the strategic reserve and weapons R&D materials are not included, the impacts to the public and to workers from the accident-free storage activities would be reduced in proportion to the decrease in the amount of material stored. The impacts from total site operations would decrease slightly. The risks of accidents would also tend to be lower.

Phaseout

Normal Operations. A phaseout of existing HEU storage facilities at ORR would reduce the impacts from radiological and chemical releases and exposures to levels very slightly below the No Action levels. As shown in Table 4.2.5.9–1, the radiological dose to the MEI from annual operations would be reduced by 1.4×10^{-3} mrem; the dose to the population would be reduced by 0.022 person-rem. The associated reductions in fatal cancer are included in the table. All workers involved in the transfer of the HEU from existing storage would be monitored to assure that their doses remain within regulatory limits and ALARA.

Facility Accidents. The phaseout operation will be conducted in accordance with DOE Orders to ensure that the risk to the public of prompt fatalities due to accidents or of cancer fatalities due to operations will be minimized. For current operations in the facility that would be phased out, the safety of workers and the public from accidents is controlled by Technical Safety Requirements that are specified in SARs or Basis for Interim Operations documents that have been prepared for the facility. Prior to initiating phaseout, the potential for accidents that could impact workers and the public will be assessed and, if necessary, applicable existing safety documentation will be modified to ensure safety for workers and the public.

4.2.5.10 Waste Management

This section summarizes the impacts on waste management at ORR under No Action and for each of the long-term storage alternatives to include the phaseout of HEU storage. There is no spent nuclear fuel or HLW associated with Pu or HEU storage. Table 4.2.5.10-1 lists the projected waste generation rates and treatment, storage, and disposal capacities under No Action for the ORR for 2005. Projections for No Action were derived from the most recent available environmental data, with the appropriate adjustments made for those changing operational requirements where the volume of wastes generated were identifiable. The projection does not include wastes from future, yet uncharacterized, environmental restoration activities. The projections for No Action could change significantly depending on the decisions resulting from the PEIS on waste management being prepared by the Department. Table 4.2.5.10-2 provides the estimated incremental operational waste volumes projected to be generated at ORR as a result of the various storage alternatives prior to treatment. Some of the waste values described in this section are different than the waste values in the table. For those values that differ (for example LLW), the table gives waste generated pre-treatment values and the text discusses post-treatment values (indicated as after treatment and volume reduction). For example, the collocated new Pu storage facility and new HEU storage facility would generate 2.1 m³ (555 gal) of liquid LLW. Since ORR already stores HEU, the waste volumes associated with the phaseout of HEU storage (0.4 m³ [106 gal]) must be subtracted out to avoid double counting waste volumes associated with HEU storage. This results in a net incremental increase from the alternative of 1.7 m³ (449 gal). The subtraction of phaseout volumes to avoid the double counting of waste volumes is only applicable to the collocation alternative (new Pu and HEU storage facility). The waste volumes generated from the various storage alternatives and the resultant waste effluent used for the waste impact analysis can be found in Section E.3.1. For the collocation alternative (new Pu and HEU facility), the waste effluent volumes in the impact analysis refer only to wastes from the applicable storage facility, not the net incremental increase/decrease for ORR as a whole. Facilities that would support the storage of Pu and/or HEU would treat and package all waste generated into forms that would enable staging and/or disposal in accordance with RCRA and other applicable statutes. Depending in part on decisions in the ROD for the Waste Management PEIS, wastes could be treated and disposed of onsite or at regionalized or centralized DOE sites. For the purposes of analyses only, this PEIS assumes that TRU and mixed TRU waste would be treated onsite to the current planning-basis WIPP WAC, and shipped to WIPP for disposal. This PEIS also assumes that LLW, mixed LLW, hazardous, and nonhazardous waste would be treated and disposed of in accordance with current site practice.

No Action Alternative

Under this alternative spent nuclear fuel and TRU, low-level, mixed, hazardous, and nonhazardous wastes would continue to be generated at ORR from the missions outlined in Section 3.6. Under No Action, ORR would continue to store HEU, and treat, store, and dispose of its legacy and newly generated wastes in current and planned facilities.

A small quantity of spent nuclear fuel could be generated by the ORNL High-Flux Isotope Reactor in the production of isotopes for commercial applications and in conducting research. The reactor pool is almost full, but reracking positions for the fuel is under way. This will provide storage space for the spent fuel generated by the reactor until 2000 (OR LMES 1996a:3-3,3-4). Installing modular dry storage units at the site for further storage is being planned (DOE 1995w:3.2-12). Other fuel and irradiated nuclear material is stored in various locations at ORR. In accordance with the ROD (60 FR 28680) from the *Department of Energy Programmatic Spent Nuclear Fuel Management and Idaho National Engineering Laboratory Environmental Restoration and Waste Management Programs Final Environmental Impact Statement* (DOE-EIS-0203-F), ORR would ship 46 t (51 tons) of spent nuclear fuel to INEL and SRS.

Small quantities of TRU waste would be generated from isotope production and research activities at ORNL. Most of this waste would be generated in remedial action projects. TRU waste previously buried and stored

would be repackaged into TRUPACT-II containers for eventual shipment to WIPP. If shipments to WIPP were delayed, plans for additional TRU storage facilities would be incorporated in the design of these facilities.

Liquid LLW would be solidified, neutralized, and allowed to evaporate. Some liquid waste would also be incinerated. Solid LLW would be compacted and stored onsite at K-25 and ORNL. Contaminated scrap metal would be processed for beneficial reuse where possible, including the DOE Shielding Block Program, or be size-reduced for disposal. Hazardous waste would be treated in both onsite and offsite RCRA-permitted facilities. Disposal of hazardous wastes would be provided by offsite facilities licensed to dispose of waste regulated under RCRA.

Mixed waste would be treated and disposed of according to the ORR Site Treatment Plan, which was developed pursuant to the *Federal Facility Compliance Act*. Liquid mixed waste would also be incinerated at the TSCA Incinerator. The resulting waste would then be stored in a RCRA-permitted facility in DOT-approved containers until it is shipped to an offsite DOE disposal facility. Some of this waste would be placed in interim storage until new technologies for treatment and disposal are identified and evaluated.

A new industrial pretreatment facility for liquid discharges from Y-12 to the City of Oak Ridge sanitary system would be constructed under the terms of their Industrial Pretreatment Permit. Nonhazardous sanitary and nonradioactive process waste liquids would be treated in conventional sewage treatment plants. The resultant solids would be disposed of with solid nonhazardous waste in a permitted landfill sized to handle projected future waste volumes.

Upgrade Alternative

Preferred Alternative: Modify Existing Y-12 Plant for Continued Highly Enriched Uranium Storage

Construction and operation of an upgraded HEU storage facility would have a minimal impact on existing ORR waste management activities. Waste generated during construction would consist of solid LLW and nonhazardous waste. The nonhazardous waste would be disposed of as part of the construction project by the contractor. The low-level contaminated concrete would be placed in appropriate containers and shipped to a DOE LLW disposal facility. The low-level contaminated steel would go to the contaminated Scrap Metal Yard, where it would be shipped to an offsite contractor for processing for beneficial reuse where possible, including the DOE Shielding Block Program.

Operation of the upgraded facility presents very little increase in low-level, mixed, hazardous, and nonhazardous waste volumes as compared to the No Action volumes for any waste category. The contribution of this operation to the ORR waste management activities is illustrated in Table 4.2.5.10-2 and could easily be handled by existing waste management facilities.

Collocation Alternative

Construct New Plutonium Storage Facility; Maintain Existing Highly Enriched Uranium Storage Facilities at Y-12 Plant

Construction and operation of a consolidated Pu storage facility in conjunction with No Action for HEU storage would have an impact on existing ORR waste management activities, increasing the generation of TRU, low-level, mixed, hazardous, and nonhazardous wastes. Waste generated during construction would consist of wastewater, and solid nonhazardous and hazardous wastes. The nonhazardous waste would be disposed of as part of the construction project by the contractor, and the hazardous waste would be shipped to commercial RCRA-permitted treatment and disposal facilities. No soil contaminated with hazardous material or radioactive constituents is expected to be generated during construction. However, if any was generated it would be managed in accordance with site practice and all applicable Federal and State regulations.

After treatment and volume reduction of TRU waste, approximately 5 m^3 (7 yd^3) of TRU waste and 4 m^3 (5 yd^3) of mixed TRU waste from leaded gloves, windows, and contaminated lead shielding would be treated and packaged to meet the current planning-basis WIPP WAC or alternative treatment level. While awaiting shipment to WIPP (depending on decisions made in the ROD associated with the supplemental EIS for the proposed continued phased development of WIPP for disposal of TRU waste), TRU and mixed TRU wastes would be stored in above-grade storage facilities. One additional truck shipment per year or, if applicable, one regular train shipment every 2 years or one dedicated train shipment every 6 years would be required to transport these wastes to WIPP.

Following treatment and volume reduction, approximately 630 m^3 (824 yd^3) of LLW would require storage/disposal after treatment at ORR. Assuming a land usage of $3,300 \text{ m}^3/\text{ha}$ ($1,700 \text{ yd}^3/\text{acre}$), this would require 0.2 ha/yr (0.5 acres/yr) of LLW disposal area. If onsite disposal at ORR is not possible, approximately 38 LLW shipments per year to a DOE disposal facility would be required. The 0.2 m^3 (50 gal) of liquid mixed LLW and 65 m^3 (85 yd^3) of solid mixed LLW would be treated and disposed of in accordance with ORR Site Treatment Plan through the use of existing and planned facilities. The additional 2 m^3 (476 gal) of liquid hazardous waste and 2 m^3 (3 yd^3) of solid hazardous wastes would have minimal impact on waste management activities at ORR, as existing and planned facilities are adequate to store the increase while awaiting shipment to offsite RCRA-permitted facilities. Approximately $136,630 \text{ m}^3$ (36,100,000 gal) of liquid nonhazardous waste may require construction of utility and process wastewater treatment systems. The existing sanitary treatment system would be adequate. After volume reduction, 670 m^3 (876 yd^3) of solid nonhazardous wastes would require disposal at the onsite landfill.

Construct New Plutonium Storage Facility and Modify Existing Highly Enriched Uranium Storage Facilities at Y-12 Plant

Construction and operation of a consolidated Pu storage facility collocated with HEU upgrade would have an impact on existing ORR waste management activities, increasing the generation of TRU, low-level, mixed, hazardous, and nonhazardous wastes. Waste generated during construction would consist of wastewater, nonhazardous solids, and hazardous wastes. The nonhazardous waste would be disposed of as part of the construction project by the contractor, and the hazardous wastes would be shipped to commercial RCRA-permitted treatment and disposal facilities. The impacts would be identical to those presented in the previous section.

Construct New Plutonium and Highly Enriched Uranium Storage Facilities

Construction and operation of a consolidated Pu storage facility collocated with HEU storage would have an impact on existing ORR waste management activities, increasing the generation of TRU, low-level, mixed, hazardous, and nonhazardous wastes. Waste generated during construction would consist of wastewater, nonhazardous solids, and hazardous wastes. The nonhazardous waste would be disposed of as part of the construction project by the contractor, and the hazardous waste would be shipped to a commercial RCRA-permitted treatment and disposal facility. The sources of wastes are similar to those of the consolidated Pu storage facility with HEU upgrade; however, the quantity with the exception of TRU waste would change. The impacts from TRU waste would be identical to those identified in the two previous options.

Following treatment and volume reduction, approximately 630 m^3 (824 yd^3) of LLW contaminated with Pu and 20 m^3 (26 yd^3) of LLW contaminated with uranium would require treatment and storage/disposal at ORR. Assuming a land usage of $3,300 \text{ m}^3/\text{ha}$ ($1,700 \text{ yd}^3/\text{acre}$), this would require 0.2 ha/yr (0.5 acres/yr) of LLW disposal area. If onsite disposal at ORR is not possible, approximately 39 LLW shipments per year to a DOE disposal facility would be required. The 0.2 m^3 (55 gal) of liquid mixed LLW and 66 m^3 (86 yd^3) of solid mixed LLW would be treated and disposed of through the use of existing and planned facilities. The 2 m^3 (528 gal) of liquid hazardous waste and 2 m^3 (3 yd^3) of solid hazardous waste would have minimal impact on waste management activities at ORR, as existing and planned facilities are adequate to store the increase while

awaiting shipment to offsite RCRA-permitted facilities. The 171,840 m³ (45,400,000 gal) of liquid nonhazardous waste may require construction of utility and process wastewater treatment systems. The existing sanitary treatment system would be adequate. After volume reduction, 870 m³ (1,140 yd³) of solid nonhazardous waste would require disposal at the onsite landfill.

Subalternative Not Including Strategic Reserve and Weapons Research and Development Materials

The exclusion of strategic reserve and weapons R&D materials would reduce the amount of operational waste volumes shown in Table 4.2.5.10–2 for the No Action Alternative, the Upgrade Alternative, and the Collocation Alternative. The decrease would be proportional to the amount of material excluded. [Text deleted.]

Phaseout

The phaseout of HEU storage would have little impact on ORR waste management activities. The quantities of waste would decrease by the increments shown in Table 4.2.5.10–2.

4.2.6

SAVANNAH RIVER SITE

A listing of the proposed long-term storage alternatives, subalternatives, and related actions, including the No Action Alternative, at SRS is provided below. The potential impacts of implementing these alternatives and related actions at SRS are described in the following sections: land resources, site infrastructure, air quality and noise, water resources, geology and soils, biological resources, cultural and paleontological resources, socioeconomics, public and occupational health and safety, and waste management. The specific long-term storage alternatives proposed for SRS are the Preferred Alternative, the Upgrade Alternative, the Consolidation Alternative, and the Collocation Alternative.

Preferred Alternative***Upgrade With RFETS Non-Pit Pu Subalternative:***

Modify APSF in F-Area to accommodate RFETS non-pit Pu not including strategic reserve and weapons R&D materials. This subalternative involves a similar but smaller expansion of the APSF compared to the Upgrade with All or Some RFETS Pu or LANL Pu Subalternative.

Proposed Storage Activities at Savannah River Site

- **No Action Alternative:** Continue to store SRS Pu material within the scope of this PEIS in the APSF in F-Area in stabilized form pursuant to DNFSB Recommendation 94-1.
- **Upgrade Alternative:** There are three subalternatives under this storage alternative.
 - ***Upgrade With RFETS Non-Pit Pu Subalternative (Preferred Alternative):*** Modify APSF in F-Area to accommodate RFETS non-pit Pu not including strategic reserve and weapons R&D materials. This subalternative involves a similar but smaller expansion of the APSF compared to the Upgrade with All or Some RFETS Pu or LANL Pu Subalternative.
 - ***Upgrade Without RFETS Pu or LANL Pu Subalternative:*** Since the APSF would be a new facility, the storage subalternative does not apply to SRS.
 - ***Upgrade With All or Some RFETS Pu and LANL Pu Subalternative:*** Modify APSF in F-Area to accommodate SRS, and RFETS and LANL Pu material.
- **Consolidation Alternative:** Construct a new facility east of Z-Area to accommodate all Pu material within the scope of this PEIS.
- **Collocation Alternative:** Construct a new facility east of Z-Area to accommodate all Pu and HEU material within the scope of this PEIS.
- **Subalternative Not Including Strategic Reserve and Weapons Research and Development Materials:** Facility and other resource requirements would be smaller than the No Action Alternative, the Upgrade with All or Some RFETS Pu and LANL Pu Subalternative, the Consolidation Alternative, and the Collocation Alternative.
- **Phaseout:** SRS Pu material within the scope of this PEIS would be moved out of F-Area to the Consolidation or Collocation site (located at another DOE site) or to disposition (for surplus Pu).

4.2.6.1 Land Resources

No Action Alternative

Under this alternative, SRS non-pit Pu material would be stored in a new F-Area facility (proposed APSF) in stabilized form. The ongoing (no new action) activities conform with present and future land-use plans, policies, and controls. Therefore, no impacts on land use or visual resources would be anticipated at SRS beyond those of existing and future activities that are independent of the proposed action.

Upgrade Alternative

Preferred Alternative: Upgrade With Rocky Flats Environmental Technology Site Non-Pit Plutonium Subalternative

Modify Actinide Packaging and Storage Facility for Continued Plutonium Storage

The new APSF in the F-Area would be modified to accommodate SRS non-pit Pu material and RFETS non-pit Pu material. The existing F-Area building and maintenance facilities would support the new facility. The modification would increase the existing footprint of the APSF, however, the facility would be situated entirely within a previously-disturbed protected area. A 1.6-km (1-mi) buffer zone is established for the F-Area.

Land Use. Facility construction and operation would conform with existing and future land use as designated by the current *Savannah River Site Development Plan*. According to the Plan, current F-Area land use is designated industrial operations, while the future land-use category is primary industrial mission. Specifically, the F-Area is one of four SRS waste management areas (SR DOE 1994d:2,11,12). As discussed in Section 4.2.6.8, no in-migration of workers would be required during construction or operation. Therefore, no indirect effects to offsite land use would occur.

Facility modification would not affect other land uses at SRS. There is no prime farmland on SRS. Construction would not be in conflict with land-use plans, policies, and controls of adjacent counties and cities since they do not address SRS. No additional effects to land use would be anticipated from operations.

Visual Resources. Construction and operation affects would be consistent with the industrial landscape character and current VRM Class 5 designation of the F-Area. Due to distance, hilly terrain, and forest cover, visual effects to public access roads with high sensitivity levels (State Highway 125 and SRS Route 1) would not occur.

[Text deleted.]

Upgrade With All or Some Rocky Flats Environmental Technology Site Plutonium and Los Alamos National Laboratory Plutonium Subalternative

Modify Actinide Packaging and Storage Facility for Continued Plutonium Storage

The new APSF in the F-Area would be modified to accommodate SRS, RFETS, and LANL Pu material. The existing F-Area buildings and maintenance facilities would support the new facility. The facility would be situated entirely within a previously disturbed protected area. A 1.6-km (1-mi) buffer zone is established for the F-Area.

Although the increase in existing building footprint would be slightly larger than the Upgrade With RFETS Non-Pit Pu Subalternative, the same overall land area would be required. Therefore, direct and indirect impacts on land resources would be anticipated to be similar.

Consolidation Alternative

Construct New Plutonium Storage Facility

Under this alternative, all Pu within the scope of this PEIS would be stored at a single new storage facility to be constructed at SRS. The proposed facility location is an undisturbed, forested area east of the Z-Area. The consolidated Pu storage plant would disturb 58.5 ha (144 acres) of land area during construction of which 56 ha (138 acres) would be used during operations. A buffer zone would be provided between facilities and the SRS site boundary. Pu storage in existing DOE facilities would be phased out.

Land Use. Facility construction and operation of a new consolidated facility for Pu storage would convert undeveloped, forested land to a developed use. However, the proposed action would conform with the current *Savannah River Site Development Plan*, which designates the future land use of the proposed facility site for the primary industrial mission (SR DOE 1994d:11). [Text deleted.] As discussed in Section 4.2.6.8, no in-migration would occur during construction and only minimal in-migration during operation. Accordingly, there would be minimal impacts to the housing sector. Therefore, no indirect effects on offsite land use would occur.

The facility site would be situated on lands managed by U.S. Forest Service (forest management activities). Since the majority of SRS land area is forested and the forest management program at SRS encompasses a broad range of activities, use of this land area would be anticipated to have an inconsequential effect on the program (SR DOE 1984a:8). Construction and operation would not affect other land uses at SRS. There are no prime farmlands on SRS. Construction and operation would not be in conflict with land-use plans, policies, and controls of adjacent jurisdictions since they do not address SRS.

Visual Resources. The current VRM Class 4 designation of the facility site would be changed to Class 5. Due to distance, hilly terrain, and forest cover, visual effects on public access roads with high sensitivity levels (State Highway 125 and SRS Route 1) visual effects would not occur. [Text deleted.]

Collocation Alternative

Construct New Plutonium and Highly Enriched Uranium Storage Facilities

All HEU and Pu within the scope of this PEIS would be stored at a primary new storage plant at SRS. The proposed facility location would be east of Z-Area on an undisturbed parcel presently forested. The disturbed area would be 89.5 ha (221 acres) during construction of which 87 ha (215 acres) would be used during operations. A buffer zone would be provided between facilities and the SRS boundary. Pu and HEU storage in existing DOE storage facilities would be phased out. Direct impacts on land resources would be similar to the Consolidation Alternative. As discussed in Section 4.2.6.8, in-migration is anticipated during construction and operation. However, expected vacancies and historic housing construction rates indicate that housing would be available to accommodate the population growth. Therefore, no indirect impacts to offsite lands would occur.

Subalternative Not Including Strategic Reserve and Weapons Research and Development Materials

Under this subalternative, land effects during construction and operation would be almost the same in extent and magnitude to the No Action Alternative, Upgrade With All or Some RFETS Pu and LANL Pu Subalternative, Consolidation Alternative, and Collocation Alternative because the same facility would be almost the same. However, because the smaller quantity of material would require smaller facilities, it is likely that less land area would be disturbed during construction and used during operations. [Text deleted.]

Phaseout

No new construction or upgrade of existing facilities would occur under phaseout of the Pu storage mission. SRS Pu material would be moved out of the F-Area to a non-SRS consolidation or collocation site or to disposition. Potential impacts on visual resources could occur if facilities are not maintained.

[Text deleted.]

4.2.6.2 Site Infrastructure

The SRS infrastructure would be capable of supporting any of the storage alternatives without major modifications to the existing infrastructure. A comparison of site infrastructure and facilities resource needs for the various storage alternatives is shown in Table 4.2.6.2-1.

No Action Alternative

Savannah River Site would continue to store current inventories of Pu which would be stabilized pursuant to DNSFB Recommendation 94-1 corrective actions. Pu storage would be in the soon to be constructed APSF in the F-Area which DOE decided to build after completing the *Environmental Impact Statement, Interim Management of Nuclear Materials* (DOE/EIS-0220, October 1995). Site infrastructure requirements under No Action could continue to be met with current site capacities and structures. As a result, there would be no impacts on the site infrastructure under No Action.

Upgrade Alternative

Preferred Alternative: Upgrade With Rocky Flats Environmental Technology Site Non-Pit Plutonium Subalternative

Modify Actinide Packaging and Storage Facility for Continued Plutonium Storage

Modification of the APSF to accommodate existing quantities of non-pit Pu material relocated from RFETS would have minimal impact on the site infrastructure. Data for construction are presented in Appendix C. Operations impacts would also be minimal. This subalternative requires an additional amount of coal over that needed for storage of SRS materials without the RFETS Pu and LANL Pu material. This additional requirement would have minimal impact on the site infrastructure.

[Text deleted.]

Upgrade With All or Some Rocky Flats Environmental Technology Site Plutonium and Los Alamos National Laboratory Plutonium Subalternative

Modify Actinide Packaging and Storage Facility for Continued Plutonium Storage

Modification of the APSF to accommodate existing quantities of RFETS and LANL Pu material would have a minimal effect on the site infrastructure. Data for construction are presented in Appendix C. Operational data are summarized in Table 4.2.6.2-1. As shown, site infrastructure resource requirements and associated impacts would be proportionately more than the upgrade with RFETS non-pit Pu materials.

Since impacts associated with relocating all of the RFETS Pu and LANL Pu material to SRS are minimal for both construction and operations, relocating only a portion of this material to SRS would result in minimal impacts to the site infrastructure as well. Additional electrical energy and coal requirements would be proportionately less than that required for storage for the full amount of RFETS Pu and LANL Pu material depending on the actual amount relocated to SRS.

Consolidation Alternative

Construct New Plutonium Storage Facility

Construction of a new consolidated Pu storage facility at SRS would have minimal impact on the site infrastructure. Data for construction are presented in Appendix C. Operations impacts to the SRS infrastructure

under this subalternative would be minimal. As shown in Table 4.2.6.2-1, less than 5 km (3 mi) of roads and less than 5 km (3 mi) of railroad lines would need to be added to the site. Some additional oil and coal would have to be provided as well. Additional oil and coal would be procured through normal contractual means. Electrical infrastructure requirements would be within site capacities.

Collocation Alternative

Construct New Plutonium and Highly Enriched Uranium Storage Facilities

Constructing new collocated Pu and HEU storage facilities to accommodate long-term storage of Pu and HEU at SRS would have minimal impact on site infrastructure. Data for construction are presented in Appendix C. As shown in Table 4.2.6.2-1, less than 5 km (3 mi) of roads and less than 5 km (3 mi) of railroad lines would need to be added to the site. Operations impacts to the SRS infrastructure under this subalternative would be minimal. As shown in Table 4.2.6.2-1, some additional coal and oil over that required for the consolidation of Pu alternative would be required. As for other alternatives, this additional amount would be procured through normal contractual means.

Subalternative Not Including Strategic Reserve and Weapons Research and Development Materials

Since the existing SRS site infrastructure would be capable of supporting construction/modification and operation of facilities for the Upgrade Alternative With All or Some RFETS Pu and LANL Pu, Consolidation Alternative, and Collocation Alternative, constructing and operating such facilities without including provisions for storage of strategic reserve and weapons R&D materials could be accommodated as well. Expected reductions in amounts of annual electrical energy requirements for the various storage facilities are the only site infrastructure changes expected if this subalternative is chosen because electric usage is dependent on the amount of material. [Text deleted.]

Phaseout

This phaseout would have no impact on the site infrastructure. While Pu storage operation would cease, the storage facilities would remain and utility service would continue until D&D is accomplished.

4.2.6.3 Air Quality and Noise

Construction and operation activities associated with the No Action Alternative and the proposed storage alternatives would generate criteria and toxic/hazardous pollutants. To evaluate the air quality impacts at SRS, criteria and toxic/hazardous concentrations from the No Action Alternative and the proposed storage alternatives are compared with Federal and State standards and guidelines. Impacts from radiological airborne emissions are described in Section 4.2.6.9.

In general, all of the proposed storage facilities would emit the same types of air pollutants during construction. It is expected emissions would not exceed Federal, State, or local air quality regulations. PM₁₀ and TSP concentrations will be increased during peak construction periods.

The principal sources of emissions during construction include the following:

- Fugitive dust from land clearing, site preparation, excavation, and wind erosion of exposed ground surfaces
- Exhaust and road dust generated by construction equipment, vehicles delivering construction materials, and vehicles carrying construction workers

During operation, the concentrations of criteria and toxic/hazardous air pollutants of the individual storage facilities are predicted to be in compliance with Federal, State, and local air quality regulations or guidelines. The estimated pollutant concentrations presented in Table 4.2.6.3–1 for each of the fissile materials storage alternatives indicate little difference between alternatives with respect to impacts to air quality.

Emission rates attributable to operation of the proposed storage facilities are presented in Tables F.1.3–1 to F.1.3–3. [Text deleted.] Air pollutant emission sources associated with operations include the following:

- Operation of existing boilers for space heating
- Operation of diesel generators and periodic testing of emergency diesel generators
- Exhaust and road dust generated by vehicles delivering supplies and bringing employees to work
- Toxic/hazardous pollutant emissions from facility processes

Noise impacts during either construction or operation are expected to be low. Air quality and noise impacts for each storage alternative are described separately. Supporting data for the air quality and noise analyses are presented in Appendix F.

AIR QUALITY

An analysis was conducted of the potential air quality impacts of emissions from each of the fissile material storage alternatives as described in Section 4.1.3.

Section 176 (c) of the 1990 CAA Amendments requires that all Federal actions conform with the applicable SIP. EPA has implemented rules that establish the criteria and procedures governing the determination of conformity for all Federal actions in nonattainment and maintenance areas. These are discussed in Section 4.1.3. The attainment status of the area in which SRS is located is discussed in Section 3.7.3. Since the area is considered an attainment area for criteria pollutants, the proposed actions at this site do not require that a conformity analysis be performed.

No Action Alternative

The No Action Alternative is based upon estimated air emissions data from total site operations at SRS assuming continuation of site missions as described in Section 3.7. These data reflect conservative estimates of criteria and toxic/hazardous emissions at SRS. The emission rates for the criteria and toxic/hazardous pollutants for No Action are presented in Table F.1.2.7–1. Table 4.2.6.3–1 presents the No Action concentrations. During dry and windy conditions, increased PM₁₀ and TSP concentrations may occur due to ongoing construction associated with other activities (that are outside of the scope of this PEIS) under the No Action Alternative. Concentrations of all other criteria and toxic/hazardous air pollutants at the site boundary or public access highways are expected to remain within applicable Federal, State, and local ambient air quality standards.

Upgrade Alternative

Preferred Alternative: Upgrade With Rocky Flats Environmental Technology Site Non-Pit Plutonium Subalternative

Modify Actinide Packaging and Storage Facility for Continued Plutonium Storage

Incremental air quality impacts attributable to increased pollutant concentration during operations are expected to be negligible for this subalternative relative to the No Action Alternative as presented in Table 4.2.6.3–1.

[Text deleted.]

Upgrade With All or Some Rocky Flats Environmental Technology Site and Los Alamos National Laboratory Plutonium Subalternative

Modify Actinide Packaging and Storage Facility for Continued Plutonium Storage

Incremental air quality impacts attributable to increased pollutant concentration during operations are expected to be negligible for this subalternative relative to the No Action Alternative as presented in Table 4.2.6.3–1.

Consolidation Alternative

Construct New Plutonium Storage Facility

Air quality impacts for construction of this alternative include increased PM₁₀ and TSP concentrations that would typically not exceed Federal, State, or local air quality regulations. During operation, concentrations of criteria and toxic/hazardous air pollutants are predicted to be in compliance with Federal, State, and local air quality regulations or guidelines. Estimated pollutant concentrations attributable to increased operations associated with this storage alternative plus the No Action concentrations are presented in Table 4.2.6.3–1.

Collocation Alternative

Construct New Plutonium and Highly Enriched Uranium Storage Facilities

The collocation storage facilities would be located in the same area as the new Pu storage facility and would have similar air quality impacts, with the following exceptions. During operation, emissions would be higher, as shown in Appendix F. Concentrations of criteria and toxic/hazardous air pollutants are predicted to be in compliance with Federal, State, and local air quality regulations or guidelines. Estimated pollutant concentrations, attributable to increased operations associated with this storage alternative, plus the No Action concentrations are presented in Table 4.2.6.3–1.

Subalternative Not Including Strategic Reserve and Weapons Research and Development Materials

Air quality impacts for construction and operation for this subalternative are expected to be similar to those for the No Action Alternative, the Upgrade With All or Some RFETS and LANL Pu Subalternative, the Consolidation Alternative, and the Collocation Alternative. [Text deleted.]

Phaseout

Phaseout of existing Pu inventories as a result of consolidating Pu at another site is expected to result in a small reduction in air pollutant concentrations from the No Action concentrations and would be in compliance with Federal and State standards.

NOISE

The location of the proposed storage facilities relative to the site boundary and sensitive receptors was examined to evaluate the potential for onsite and offsite noise impacts. Noise sources during construction may include heavy construction equipment and increased traffic. Increased traffic would occur onsite and along offsite local and regional transportation routes used to bring construction material and workers to the site.

No Action Alternative

Nontraffic noise sources associated with continued interim storage and other ongoing missions are the same as described in Chapter 3. The continuation of operations at SRS would result in no appreciable change in traffic noise and onsite operational noise sources from current levels. Nontraffic noise sources are located at sufficient distance from offsite areas that the contribution to offsite noise levels would continue to be small. Due to the size of the site, noise emissions from construction equipment and operations activities would not be expected to cause annoyance to the public. Some noise sources may be located close enough to onsite noise-sensitive areas to result in impacts, such as disturbance of wildlife.

Upgrade (Preferred Alternative), Consolidation, and Collocation Alternatives

Nontraffic noise sources associated with the storage upgrade alternative would be similar to those for existing facilities, as discussed in Chapter 3. Nontraffic, operational noise sources associated with the storage alternatives include existing and additional equipment and machines (cooling systems, vents, motors, and material handling equipment). These noise sources would be located at sufficient distance from offsite areas that the contribution to offsite noise levels would be small. Due to the size of the site, noise emissions from construction equipment and operations activities would not be expected to cause annoyance to the public. Some noise sources may result in impacts, such as disturbance of wildlife.

Subalternative Not Including Strategic Reserve and Weapons Research and Development Materials

Noise impacts for construction and operations for this option are expected to be almost the same as those previously described for the No Action Alternative, the Upgrade With All or Some RFETS and LANL Pu Subalternative, the Consolidation Alternative, and the Collocation Alternative because noise impacts are based on the use of the facility and not the size. [Text deleted.]

Phaseout

A reduction in noise levels associated with facility operations may result from the phaseout of storage facilities.

4.2.6.4 Water Resources

Impacts associated with the construction and operation of the potential long-term storage facilities at SRS would affect water resources. The proposed facilities would be located outside the 100-year floodplain. Information on the location of the 500-year floodplain at SRS is currently available only for a limited number of specific project areas, but this information could be developed in future environmental documentation. Groundwater would be used for construction and operation of the facilities. The water withdrawals from groundwater would not affect regional groundwater levels. No wastewater would be discharged directly to groundwater, so groundwater quality would not be affected. Any construction-related impacts would be mitigated by standard erosion control practices. During operation of the facilities, treated wastewater would be discharged to nearby streams. All discharges would be monitored to comply with permit limits. During operation, stormwater runoff would be collected and treated, if necessary, before discharge to natural drainage channels. Table 4.2.6.4–1 presents No Action water resources uses and discharges and the potential change resulting from long-term storage alternatives.

No Action Alternative

Surface Water. [Text deleted.] A description of the activities that would continue at SRS is provided in Section 3.7. Because the K-Reactor is shutdown with no provisions for restart, surface water withdrawals from the Savannah River would decrease from 140,400 million l/yr (37,100 million gal/yr) to 127,000 million l/yr (33,600 million gal/yr), or 2.6 percent of the river's minimum flow, by the year 2005. As a result of reduced discharges to site streams, water quality would improve. Treated wastewater discharged is expected to continue at a rate of 700 million l/yr (185 million gal/yr).

Groundwater. Under this alternative, no additional impacts to groundwater resources are anticipated beyond those of existing and future activities, which are independent of and not affected by the proposed action. Groundwater withdrawals for operations of facilities at SRS are expected to remain the same as current usage of 13,247 million l/yr (3,500 million gal/yr) by the year 2005. With the K-Reactor shutdown, and, given the continued implementation of strict waste handling/management practices, it is expected that groundwater quality would not be further degraded.

Upgrade Alternative

Preferred Alternative: Upgrade With All or Some Rocky Flats Environmental Technology Site Non-Pit Plutonium Subalternative

Modify Actinide Packaging and Storage Facility for Continued Plutonium Storage

Surface Water. No surface water withdrawals would be made. Groundwater would be used for construction and operation of the F-Area facilities. The primary surface water impacts during construction would result from soil erosion of disturbed land and siltation of surface drainage channels. To minimize soil erosion impacts, stormwater management and erosion control measures would be employed. In most cases, impacts from runoff would be temporary and manageable. During operation, stormwater runoff would be collected, monitored, and treated, if necessary, before discharge to natural drainage channels.

During construction of the new F-Area facilities, sanitary wastewater (approximately 1.7 million l/yr [0.4 million gal/yr]), would be generated and discharged to the sitewide wastewater treatment system, which would not require any modifications to this system. This would represent a 0.2-percent increase in the effluent from this facility. During operation, approximately 1.5 million l/yr (0.4 million gal/yr) of sanitary wastewater would be discharged to this wastewater treatment system. This would represent a 0.2-percent increase in the effluent discharged to Fourmile Branch from this facility. All discharges would be monitored to comply with discharge requirements. Minimal impacts are expected.

The annual quantities of cooling water blowdown and steam condensate generated would be 3.78 million l (1 million gal) and 2.0 million l (530,000 gal), respectively. Cooling system blowdown would be routed to existing storm drains. Steam condensate from heating would also be routed to the storm drain after quenching. Condensation from air conditioning would be recycled as cooling water makeup. All discharges would be monitored. Fire sprinkler water and truck hosedown water would be collected in tanks, monitored for radioactivity, and then transferred by pipeline or tanker to sanitary waste treatment or the ETF as required. Uncontaminated water would be pumped to storm drains.

The potential location of the new F-Area storage facility is outside the 100-year floodplain. Information on the location of the 500-year floodplain at SRS is currently available only for a limited number of specific project areas. However, the new storage facility at SRS would not likely affect, or be affected by the 500-year floodplain of either the Fourmile Branch or Upper Three Runs Creek because the facility would be located at an elevation of about 91 m (300 ft) above mean sea level (MSL) and is approximately 33 m (107 ft) and 64 m (210 ft) above these streams and at distances from these streams of 0.8 km (0.5 mi) to 1.5 km (0.94 mi), respectively. The maximum flow that has occurred on the Upper Three Runs Creek was in 1990, with a flow rate of about 58 m³/s (2,040 ft³/s). At that time the creek reached an elevation of almost 30 m (98 ft) above MSL (SR USGS 1996a:1). The elevation of the buildings in F-Area are more than 62 m (202 ft) above the highest flow elevation of the Upper Three Runs Creek. The maximum flow that has occurred on the Fourmile Branch was in 1991 with a rate of approximately 5 m³/s (186 ft³/s), and an elevation of about 61 m (199 ft) above MSL (SR USGS 1996a:1). Elevations of the buildings in F-Area are more than approximately 31 m (101 ft) higher than the maximum flow level that has occurred.

Groundwater. Water requirements during construction would be approximately 2.2 million l/yr (0.6 million gal/yr), which would represent a much less than 1-percent increase over the projected annual No Action groundwater withdrawal. This additional withdrawal should cause minimal impacts to groundwater availability. During operation, water used for cooling system makeup would be obtained from existing supply systems in the F-Area. The water for these systems is groundwater from the Cretaceous Aquifer. Water requirements shown in Table 4.2.6.4-1 represent a maximum of 0.05 percent of the present groundwater usage at SRS. These additional withdrawals would have minimal impact on regional groundwater levels. Previous studies using numerical simulations of groundwater withdrawals over 100 times greater than that required for the F-Area facilities from the Cretaceous Aquifer indicate that drawdown could be almost 2.1 m (7 ft) at the well head, but would be smaller in overlying aquifers and would not extend beyond SRS boundaries in any aquifer (DOE 1991c:5-196). Based on this analysis, it is expected that the withdrawals attributed to the upgraded Pu storage facilities would have a minor drawdown at the well head and would not affect any aquifers in the area.

Construction and operation of the proposed upgraded Pu storage facilities would not result in direct discharges to groundwater. Impacts to groundwater quality are therefore not expected. Since the supply wells draw from the deep Cretaceous Aquifer, the existing plume in the near surface aquifer under the F-Area should not be affected by the upgraded Pu storage facilities.

[Text deleted.]

Upgrade With All or Some Rocky Flats Environmental Technology Site Plutonium and Los Alamos National Laboratory Plutonium Subalternative

Modify Actinide Packaging and Storage Facility for Continued Plutonium Storage

Surface Water. Impacts to surface water from this subalternative are similar to those discussed above for the Upgrade with RFETS Non-Pit Pu Material Subalternative. During both construction and operation, the quantities of wastewater discharged to the sitewide wastewater treatment system would be slightly greater than for the previous subalternative. As shown in Table 4.2.6.4-1, the increases in wastewater discharge during

construction and operation are 0.1-percent greater than those for the previous subalternative; no impacts are expected. Other surface water impacts are identical to those discussed above for the previous subalternatives.

Groundwater. Impacts to groundwater from this subalternative are also similar to those discussed above for the Upgrade with RFETS Non-Pit Pu Material Subalternative. Water requirements during construction and operation of this subalternative are slightly greater than for the previous subalternative. The quantities required for this subalternative represent a maximum increase of 0.05-percent over the No Action groundwater requirements; no impacts to groundwater availability are expected. Impacts to groundwater quality are not expected to be minimal for the same reasons described above for the previous subalternative.

Consolidation Alternative

Construct New Plutonium Storage Facility

The impacts associated with a new consolidated Pu storage facility are the same as those discussed above for the new F-Area facility, with the following exceptions. The water requirements of this alternative are greater than those for the previous alternative. This alternative would require approximately 85 million l/yr (22.5 million gal/yr) and 360 million l/yr (95 million gal/yr) of water for construction and operation, respectively. These additional requirements represent 0.6- and 2.7-percent increases, respectively, in the projected annual withdrawals from the Cretaceous Aquifer. Based on the previous discussion of potential groundwater level declines due to increased withdrawals, minor declines at the well head could be expected to occur from these additional withdrawals during construction. Water requirements during operation are approximately 7 percent less than the quantity analyzed in the groundwater level decline study previously discussed. Based on the results of that study, minimal impacts to regional groundwater levels are expected.

Sanitary wastewater quantities generated during construction and operation of this alternative are approximately 8 million l/yr (2.1 million gal/yr) and 169 million l/yr (44.6 million gal/yr), respectively. These effluents would be treated at the sitewide wastewater treatment system and then discharged to Fourmile Branch. This quantity of additional wastewater during operation would represent a 24.1-percent increase in the effluent discharged to Fourmile Branch from this facility. The sitewide wastewater treatment system can control its effluent flow to Fourmile Branch, and restrictions are specified in the NPDES permit.

Surface water would not be used for this alternative, so no impacts to surface water availability would occur. The area proposed for the new Pu storage facility is outside the 100-year floodplain. No assessment of the 500-year floodplain has been conducted in this area but could be developed during the siting process.

Collocation Alternative

Construct New Plutonium and Highly Enriched Uranium Storage Facilities

Because the consolidated and collocated storage facilities would be located in the same area as the Pu storage facility (that is, northeast of the Z-Area at SRS), the impacts associated with it are the same as those discussed above, with the following exceptions. The water requirements for construction and operation of this alternative are slightly greater. This alternative would require approximately 104.7 million l/yr and 460 million l/yr (27.7 million gal/yr and 121.5 million gal/yr) for construction and operation, respectively. These additional requirements represent 0.8- and 3.5-percent increases, respectively, in the projected annual withdrawals from the Cretaceous Aquifer. Based on the previous discussion of potential groundwater level declines due to increased withdrawals, minor declines at the well head during construction could be expected to occur. Water requirements during operation would be approximately 18 percent greater than those analyzed during the potential groundwater level decline previously discussed. Impacts from these additional withdrawals would be analyzed in tiered NEPA documents, as appropriate.

Sanitary wastewater quantities generated during construction and operation of this alternative would be greater than for the previous alternative and are approximately 13.0 million l/yr and 215 million l/yr (3.4 million gal/yr and 56.8 million gal/yr), respectively. These effluents would be treated at the sitewide wastewater treatment system and then discharged to Fourmile Branch. This quantity of additional wastewater during operation would represent a 30.7-percent increase in the discharge to Fourmile Branch and would be approximately 4.3 percent of the minimal flow. [Text deleted.]

Subalternative Not Including Strategic Reserve and Weapons Research and Development Materials

Water resource impacts during construction and operation for this subalternative are expected to be slightly less than those for the No Action Alternative, the Upgrade With All or Some RFETS Pu and LANL Pu Subalternative, the Consolidation Alternative, and the Collocation Alternative because of the reduction in the amount of material. [Text deleted.]

Phaseout

For phaseout of the current Pu storage mission at SRS, groundwater withdrawals from the Cretaceous aquifer and nonhazardous wastewater discharge to Fourmile Branch would decrease by negligible quantities. By decreasing groundwater withdrawals, SRS would lessen its impact on the Cretaceous Aquifer by a negligible amount. Lowering wastewater discharges to Fourmile Branch by this quantity should not cause or alleviate any noticeable impacts.

[Text deleted.]

4.2.6.5 Geology and Soils

Construction and operation of the alternatives at SRS would have no impact on the geologic resources. Based on the seismic history of the area, a low seismic risk exists, and would be considered in the design of the proposed alternatives. The existing seismic risk does not preclude the safe construction and operation of the proposed alternative facilities. The facilities would be designed for earthquake-generated ground acceleration in accordance with DOE O 420.1, *Facility Safety*. Because there are no known capable faults at SRS, ground rupture as a result of an earthquake during the lifetime of the facility is minimal; ground shaking is more likely. Intensities of more than VII on the MMI scale are possible but infrequent and are not likely at SRS. Ground shaking could affect the integrity of inadequately designed or nonreinforced structures but would not affect newly designed facilities. Human health effects from accidents initiated by natural phenomena (for example, earthquakes) are discussed in Section 4.2.6.9. There is no evidence to suggest that seismically induced liquefaction of soils represents a hazard at SRS (DOE 1995p:4-23). Volcanic activity is improbable during the life of a facility and is not anticipated to affect the construction and operation of the alternatives. It is unlikely that landslides or other nontectonic events would affect the proposed alternatives. Calcium carbonate dissolution (within thin, discontinuous calcareous sand zones) may be an active process in the area, but no surface expression of sinkholes or fractures associated with calcium carbonate dissolution have been identified at SRS. Potential effects due to subsidence should be negligible because calcium carbonate dissolution is a slow process relative to human activities. Properties and conditions of soils underlying SRS typically have no limitations on construction. No economically viable geologic resources are known to be present at SRS.

Construction of the alternatives may involve ground-disturbing activities that could affect the soil resources. The amount of land disturbed is specified below for each alternative. Effects to the soil resource would depend on the specific soil units in the disturbed area, the extent of land disturbing activities, and the amount of soil disturbed. Within SRS, the soil erosion potential is directly related to the amount of land disturbed because soil and climatic conditions are similar throughout the site. Control measures would be employed to minimize soil erosion.

[Text deleted.]

No Action Alternative

[Text deleted.] Under this alternative, DOE would continue current and ongoing activities at SRS. There would be no ground-disturbing activities beyond those associated with existing and future site improvements. Because no new construction and the associated ground disturbance for potential soil erosion would occur, the No Action Alternative would have no effect to geologic or soil resources at the site.

Upgrade Alternative

Preferred Alternative: Upgrade With Rocky Flats Environmental Technology Site Non-Pit Plutonium Subalternative

Modify Actinide Packaging and Storage Facility for Continued Plutonium Storage

Construction would occur on previously disturbed land as described in Section 4.2.6.1. Soil disturbance would occur primarily from ground-disturbing construction activities (foundation preparation) and activities associated with building construction laydown areas that can expose the soil profile and lead to a possible increase in soil erosion as a result of wind and water action. Soil loss would depend on the frequency and severity of storms; wind velocities (increased wind velocities and durations increase potential soil erosion); and the size, location, and duration of ground-disturbing activities with respect to local drainage and wind patterns.

Net soil disturbance during operations would be considerably less than during construction because areas temporarily used for construction laydown would be restored. Although erosion by stormwater runoff and wind action could occur occasionally during operations, they are anticipated to be minimal.

[Text deleted.]

Upgrade With Rocky Flats Environmental Technology Site Plutonium and Los Alamos National Laboratory Plutonium Subalternative

Modify Actinide Packaging and Storage Facility for Continued Plutonium Storage

Construction and operation effects on geology and soil resources for this option would be the same as those described for the Upgrade With RFETS Non-Pit Pu Subalternative, because the amount of land disturbed during modification of the APSF would be the same.

Consolidation Alternative

Construct New Plutonium Storage Facility

No apparent direct or indirect effects on the geologic resource are anticipated because neither facility construction and operational activities nor site infrastructure improvements would restrict access to potential geologic resources. Analysis in this section is the same as that provided for the Upgrade Alternative.

[Text deleted.] Additional soil impacts would be expected from construction of the Consolidation Alternative. Construction would occur completely on undisturbed land, as described in Section 4.2.6.1. Approximately 58.5 ha (144 acres) will be disturbed during construction of the new facilities, affecting the soil profile and leading to a possible temporary increase in erosion as a result of stormwater runoff and wind action. Soil losses would depend on frequency of storms; wind velocity; location of the facility with respect to drainage and wind patterns; slope, shape, and area of the tracts of ground disturbed; and the duration of time the soil is bare.

Collocation Alternative

Construct New Plutonium and Highly Enriched Uranium Storage Facilities

No apparent direct or indirect effects on the geologic resource are anticipated, because neither facility construction and operational activities nor site infrastructure improvements would restrict access to potential geologic resources.

[Text deleted.] Additional soil impacts would be expected from the construction of the storage facilities which will occur completely on undisturbed land, as described in Section 4.2.6.1. During construction, approximately 89.5 ha (221 acres) would be disturbed for the new facilities, affecting the soil profile and leading to a possible temporary increase in erosion as a result of stormwater runoff and wind action. [Text deleted.]

Subalternative Not Including Strategic Reserve and Weapons Research and Development Materials

Excluding strategic reserve and weapons R&D materials would give almost the same effects to the geologic and soil resources. By excluding these materials, the size of a facility would be similar, thus not changing the amount of land disturbed by construction activities. No effect to the geologic resource is anticipated as a result of this option. [Text deleted.]

Phaseout

- | The phaseout of storage capacity would have no apparent effects on the geology resources. However, phaseout could result in beneficial effects on the soils of the area. Hazardous radioactive and mixed waste sources would be eliminated from the area, thus decreasing the potential for future soil contamination.
- | [Text deleted.]

4.2.6.6 Biological Resources

No Action Alternative

Under No Action, the Pu storage mission described in Section 2.2.6 would continue at SRS. These activities would result in no appreciable change to current conditions of biological resources at SRS as described in Section 3.7.6. [Text deleted.]

Upgrade Alternative

Preferred Alternative: Upgrade With Rocky Flats Environmental Technology Site Non-Pit Plutonium Subalternative

Modify Actinide Packaging and Storage Facility for Continued Plutonium Storage

Upgrading the APSF to accommodate RFETS non-pit Pu material would result in no appreciable change over the No Action Alternative since all activities would take place within a previously disturbed area.

[Text deleted.]

Upgrade With All or Some Rocky Flats Environmental Technology Site Plutonium and Los Alamos National Laboratory Plutonium Subalternative

Modify Actinide Packaging and Storage Facility for Continued Plutonium Storage

Upgrading the APSF to accommodate all or some RFETS and LANL materials would result in no appreciable change over the No Action Alternative since all activities would take place within a previously disturbed area.

Consolidation Alternative

Construct New Plutonium Storage Facility

Under this alternative, Pu materials would be consolidated in a new storage facility at SRS. Impacts to terrestrial resources, wetlands, aquatic resources, and threatened and endangered species are described below.

Terrestrial Resources. Construction of the consolidated Pu storage facility would result in the disturbance of 58.5 ha (144 acres), or less than about 0.07 percent of SRS. This includes areas on which permanent facilities would be constructed, as well as areas revegetated following construction. Vegetation within the proposed site would be lost during land-clearing activities. The majority of the proposed site consists of old fields and pine plantations that are common on SRS and throughout the region. Bottomland hardwoods and wetlands would be avoided to the extent possible.

Construction of a Pu storage facility would affect animal populations. Less mobile animals, such as amphibians, reptiles, and small mammals within the project area would not be expected to survive. Construction activities and noise would cause larger mammals and birds in the construction and adjacent areas to move to similar habitat nearby. If the area to which they moved was below its carrying capacity, these animals would be expected to survive. However, if the area was already supporting the maximum number of individuals, the additional animals would compete for limited resources, which could lead to habitat degradation and eventual loss of the excess population. Nests and young animals living within the assumed site may not survive. The site would be surveyed as necessary for the nests of migratory birds prior to construction. Upon completion of construction, revegetated areas would be of minimal value to most types of wildlife because they would be maintained as landscaped areas.

Activities associated with facility operations, such as noise and human activity, could affect wildlife living immediately adjacent to the facility. These disturbances may cause some species to move from the area. Disturbance to wildlife living adjacent to the facility would be minimized by preventing workers from entering undisturbed areas. Salt drift generated by mechanical draft cooling systems would be minimal and negligible impacts are expected.

Wetlands. Since the majority of the proposed site is upland, the facility could be located to avoid direct impacts to wetlands. Implementation of soil erosion and sediment control measures would control secondary impacts. Due to the relatively small amount of water required during both construction and operation, existing discharge structures would be used. Thus, it would not be necessary to disturb wetlands along the site streams. Any unavoidable impacts to wetlands would be mitigated according to DOE policy set forth in 10 CFR 1022 and in accordance with the requirements of a COE permit. Wastewater discharge to Fourmile Branch from construction and operation would be minimal and would not be expected to affect wetlands associated with the stream. All discharges would be treated as necessary to comply with NPDES-permit requirements.

Aquatic Resources. Stormwater runoff during construction of a Pu storage facility at SRS could cause temporary water quality changes in Fourmile Branch, Upper Three Mile Creek, and in Carolina bays. Increased turbidity could affect some fish spawning and feeding habitat. Fish populations probably would move to less-disturbed areas of the stream and recolonize disturbed areas shortly after construction is complete and water quality improves. Direct disturbance to aquatic resources in site streams are not expected since groundwater would be used for both construction and operation, and new discharge structures would not be required. During construction and operation, wastewater would be discharged to Fourmile Branch. These discharges (found in Section 4.2.6.4) would be minimal and would not be expected to affect aquatic resources. All wastewater would be treated as required.

Threatened and Endangered Species. It is unlikely that federally listed threatened or endangered species are expected to be affected by construction or operation of a consolidated Pu storage facility. Although suitable foraging habitat for the red-cockaded woodpecker exists in the area, the woodpecker colonies are located far enough from the site that this species would not be directly affected by the storage facility. Special status species that would potentially be affected by construction of the facility include the green fringed orchid, eastern tiger salamander, nailwort, and beak-rush. If present, individuals of each of these species would be lost due to land clearing activities or suffer impacts to habitat due to sedimentation of Carolina bays. Preactivity surveys would be conducted as appropriate prior to construction to determine the occurrences of these and other special status species, including the federally listed smooth coneflower (Table 3.7.6-1). Consultation with USFWS and State agencies would be conducted at the site-specific level, as appropriate.

As described in previous sections, operation of the facility would have minor effects on biotic resources. Therefore, impacts to special status species during facility operations are not expected.

Collocation Alternative

Construct New Plutonium and Highly Enriched Uranium Storage Facilities

Under this alternative, consolidated Pu materials would be stored with HEU inventories in a new collocated storage facility at SRS. Construction and operation of collocated storage facilities at SRS would have similar, but somewhat greater, effects on biological resources as those described for the consolidated storage facility. Construction of the collocated storage alternative would disturb 89.5 ha (221 acres) of habitat.

Subalternative Not Including Strategic Reserve and Weapons Research and Development Materials

The exclusion of strategic reserve and weapons R&D materials would have almost the same effects to the No Action Alternative, the Upgrade With All or Some RFETS and LANL Pu Subalternative, the Consolidation

Alternative, and the Collocation Alternative. The size of the facility would be similar and would not reduce the amount of habitat and thus lessen potential impacts to biological resources would be similar. [Text deleted.]

Phaseout

The phaseout of Pu storage facilities at SRS would not be expected to affect biological resources. Increased human activity could temporarily disturb some wildlife species in the vicinity of the site.

4.2.6.7 Cultural and Paleontological Resources

No Action Alternative

Under this alternative, DOE would continue the existing and planned missions at SRS. This includes continued storage of Pu material in F-Area in stabilized form pursuant to DNFSB Recommendation 94-1. Any impacts to cultural or paleontological resources from these missions would be independent of the proposed action and would be addressed through separate NHPA, *American Indian Religious Freedom Act*, and *Native American Graves Protection and Repatriation Act* regulatory compliance procedures. An extensive archaeological survey program began at SRS in 1974 and includes numerous field studies. A Programmatic Agreement was signed by the DOE Savannah River Operations Office, the South Carolina SHPO, and the Advisory Council on Historic Preservation in 1990 with the purpose of ensuring that appropriate measures are taken to inventory, evaluate, protect and enhance sites on SRS. In addition, there is an *Archaeological Resource Management Plan* in place at SRS.

Upgrade Alternative

Preferred Alternative: Upgrade With Rocky Flats Environmental Technology Site Non-Pit Plutonium Subalternative

Modify Actinide Packaging and Storage Facility for Continued Plutonium Storage

This option involves additions to a new facility on previously disturbed land located north of the 235-F Building and east of the 247-F Building in F-Area to accommodate SRS non-pit Pu and RFETS non-pit Pu material. Portions of the F-Area have been surveyed and contain sites potentially eligible for the NRHP. However, the areas under consideration are disturbed and the potential for cultural resources is extremely low. Some paleontological remains may occur on this acreage, but impacts would be considered negligible because the fossil assemblages known to occur at SRS are of low research value. During operation, no additional ground disturbance is expected, so there would be no additional impact to prehistoric, historic, or paleontological sites.

Some Native American resources may be affected by the proposed action. Resources such as prehistoric sites, cemeteries, and traditional plants could be affected by construction. Facility operation could result in reduced access to traditional use areas or sacred space. Visual or auditory intrusions to the areas may also result from the proposed option. These resources would be identified through consultation with the potentially affected tribes.

[Text deleted.]

Upgrade With All or Some Rocky Flats Environmental Technology Site Plutonium and Los Alamos National Laboratory Plutonium Subalternative

Modify Actinide Packaging and Storage Facility for Continued Plutonium Storage

Impacts for the addition of All or Some RFETS Pu and LANL Pu would be similar to the Upgrade With RFETS Non-Pit Pu Subalternative because no additional land would be disturbed.

[Text deleted]

Consolidation Alternative

Construct New Plutonium Storage Facility

This alternative involves the construction of a new facility on land east of the Z-Area. The total amount of land to be disturbed during construction is 58.5 ha (144 acres). The total operational land requirement is 56 ha (138 acres). A reduced-access buffer zone would exist around the facility. This acreage may contain some prehistoric and historic resources. Surveys would be conducted prior to construction. Some paleontological remains may occur on this acreage, but impacts would be considered negligible because the fossil assemblages known to occur at SRS are of low research value. During operation, no additional ground disturbance is expected, so there would be no additional impact to prehistoric, historic, or paleontological sites. Native American resources may be identified in the area. Potential impacts to these resources are also discussed under the Upgrade Alternative.

Collocation Alternative

Construct New Plutonium and Highly Enriched Uranium Storage Facilities

Under this alternative, a new facility would be constructed east of the Z-Area to accommodate all Pu and HEU within the scope of this PEIS. Land disturbed during construction would be 89.5 ha (221 acres). The operational land disturbance would be 87 ha (215 acres), and the facilities would be located in the same place as the previously discussed new Pu storage facility. A reduced-access buffer zone would exist around the facility. Effects to cultural and paleontological resources would be similar to those discussed under the Consolidation Alternative.

Subalternative Not Including Strategic Reserve and Weapons Research and Development Materials

Under this subalternative, facility and other resource requirements will be almost the same as the No Action Alternative, the Upgrade Alternative, the Consolidation Alternative, and the Collocation Alternative. Therefore, impacts to cultural and paleontological resources would be equal to those previously discussed. [Text deleted.]

Phaseout

Under this activity, all SRS Pu material would be moved out of F-Area to the consolidation or collocation sites or to disposition. No acreage is expected to be disturbed during phaseout, so impacts to archaeological and paleontological resources are not anticipated. It is possible, however, that some of the buildings involved in phaseout would be NRHP-eligible, because their original construction and function may be associated with the Cold War Era.

4.2.6.8 Socioeconomics

No Action Alternative

Regional Economy Characteristics. Total employment in the REA is projected to increase approximately 1 percent annually between 1995 and 2000, reaching about 257,000 in the latter year. Long-term projections indicate slower growth after the year 2000, when employment would increase by less than 1 percent annually and reach approximately 354,500 persons in 2040. Unemployment in the REA was 6.7 percent in 1994 and is expected to remain at this level into the near future. Per capita income is projected to increase from approximately \$17,332 in 1995 to \$25,297 in 2040. Projections for the No Action Alternative are presented in Table L.1–55.

Population and Housing. Population in the ROI is projected to increase from approximately 457,500 in 1995 to 640,200 by 2040. The total number of available housing units in the ROI is projected to increase from about 171,400 in 1995 to 239,700 in 2040. Population and housing projections for the No Action Alternative are presented in Tables L.1–56 and L.1–57, respectively.

Community Services. Education, public safety, and health care characteristics are used to assess the level of community services in the SRS ROI. School enrollments are projected to increase from about 86,730 students in 1995 to 121,620 students by 2040. The current student-to-teacher ratio is 17.5:1. To maintain this level of service, the number of teachers in the ROI would need to increase from approximately 4,966 in 1995 to 6,948 in 2040. These projections are presented in Tables L.1–58 and L.1–59.

The projected number of sworn police officers and firefighters serving in ROI communities over the period 1995 to 2040 are shown in Tables L.1–60 and L.1–61, respectively. Under No Action, the number of sworn police officers is projected to increase from approximately 952 in 1995 to 1,322 in 2040 to maintain the current service level of 2.1 sworn officers per 1,000 persons. The number of firefighters in the ROI would need to increase from about 1,363 in 1995 to 1,919 in 2040 to maintain the current service level of 3.0 firefighters per 1,000 persons.

Hospital occupancy rates are based on current capacity. These rates and the estimated number of practicing physicians serving the ROI population between 1995 and 2040 are presented in Tables L.1–62 and L.1–63, respectively. Hospital occupancy rates are projected to increase from approximately 65 percent in 1995 to 90 percent in 2040. To maintain the current service level of 3.0 physicians per 1,000 persons, the total number of physicians in the ROI would need to increase from approximately 1,350 in 1995 to 1,848 in 2040.

Local Transportation. Any increases in traffic would be due to projected growth in the area unrelated to DOE activities. [Text deleted.]

Upgrade Alternative

Preferred Alternative: Upgrade With Rocky Flats Environmental Technology Site Non-Pit Plutonium Subalternative

Modify Actinide Packaging and Storage Facility for Continued Plutonium Storage

Under this alternative, the RFETS non-pit material would be transferred to SRS. An addition to the APSF to accommodate the RFETS non-pit material would require up to 193 workers and take four months to complete. This construction project may be performed as an extension of work already being conducted under No Action. Under this scenario, there would be no additional socioeconomic impacts over the No Action level because the workers would already be on site. If, however, the construction of the RFETS non-pit addition takes place some time after No Action construction is completed, there would be some minor socioeconomic effects.

During the operation phase, 160 workers would be employed if the RFETS non-pit material is stored at SRS. However, 30 of these positions would be filled by existing SRS employees. The other 130 positions would be created as part of No Action. Thus, there would be minimal socioeconomic impacts associated with the operation of the upgraded storage facility beyond those that would result from No Action.

Regional Economy Characteristics. A maximum of 346 jobs (193 direct and 153 indirect) would be generated during construction. Total employment would increase by much less than 1 percent during construction while unemployment would drop from the No Action level of 6.7 percent to 6.6 percent. Per capita income would increase by much less than 1 percent over the No Action Alternative (Socio 1996a).

Population, Housing, Community Services, and Local Transportation. All newly created employment would be filled by the resident labor force. Therefore, there would be no change to the region's population beyond the No Action level. Accordingly, there would be no impacts to either the housing sector, or demand for community services as a result of the construction of these facilities. Local transportation would also be unaffected by the proposed action.

[Text deleted.]

Upgrade With Rocky Flats Environmental Technology Site and Los Alamos National Laboratory Plutonium Subalternative

Modify Actinide Packaging and Storage Facility for Continued Plutonium Storage

Under this alternative, all or a portion of the RFETS and LANL material would be transferred to SRS. The upgraded facility would be comparable in size to the upgraded facility described above. Therefore, the number of workers required for construction and operation of the two facilities would be the same. The socioeconomic impacts for the two alternatives would also be identical.

Consolidation Alternative

Construct New Plutonium Storage Facility

To consolidate storage of Pu currently stored at multiple DOE sites, a new storage facility would be built at SRS. Workers would in-migrate to fill a portion of the direct jobs created during construction and operation of this facility.

Regional Economy Characteristics. Construction would generate a total of 2,044 jobs (1,140 direct and 904 indirect). Operation would generate a total of 1,460 jobs (485 direct and 951 indirect). Total employment would increase by less than 1 percent for construction and operation of the facility. Unemployment would decrease to 6.0 percent during construction and 6.2 percent during operation. Per capita income would increase by less than 1 percent over the No Action Alternative during either phase (Socio 1996a).

Population, Housing, and Community Services. Most of the newly created employment would be filled by the resident labor force. There would only be approximately 35 workers in-migrating during operation and no in-migration during construction. Therefore, there would be a minimal change to the region's population beyond the No Action level. Accordingly, there would be minimal impacts to the housing sector or community services as a result of the construction and operation of this facility. [Text deleted.]

Local Transportation. A total of 2,188 and 931 vehicle trips per day would be generated during construction and operation, respectively. During construction, South Carolina State Route 230 from U.S. 25 Business at North Augusta to U.S. 1/25/78/278, a rural two-lane highway, would drop from level of service E to level of

service F. Traffic generated from facility operations would not affect the level of service on the local road segments analyzed (Socio 1996a).

Collocation Alternative

Construct New Plutonium and Highly Enriched Uranium Storage Facilities

To collocate storage of Pu and HEU currently stored at multiple DOE sites, new storage facilities would have to be built at SRS. Workers would in-migrate to fill a portion of the direct jobs created during construction and operation of these facilities.

Regional Economy Characteristics. Construction would generate a total of 2,623 jobs (1,463 direct and 1,160 indirect). Operation would generate a total of 1,818 jobs (614 direct and 1,204 indirect). Total employment would increase by about 1 percent for construction and less than 1 percent for operation. Unemployment would decrease to 5.8 percent during construction and 6.1 percent during operation. Per capita income would increase by less than 1 percent during both phases (Socio 1996a).

Population and Housing. The in-migration of workers during the construction and operation periods would increase the ROI population by much less than 1 percent over No Action projections. The largest increase would occur during construction. Some new housing may be needed. However, expected vacancies and historic housing construction rates indicate that housing would be available to accommodate the population growth (Socio 1996a).

Community Services. The additional population would slightly increase the demand for some community services. Worker in-migration would lead to an increase in ROI school enrollments by about 62 students during construction and 47 students during operation. To maintain the No Action student-to-teacher ratio of 17.5:1, the number of teachers would have to increase by three during both the construction and operation periods (Socio 1996a). This additional need for teachers would be distributed over the various jurisdictions in the ROI; therefore, the effect on any single school district would be minimal.

To maintain the No Action level of service, only one police officer would need to be hired during both construction and operation. To maintain the No Action firefighter level of service, only one firefighter would need to be hired during both phases (Socio 1996a).

The small population increase would have a negligible effect on health services, increasing hospital occupancy slightly greater than the No Action projection. The number of physicians in the ROI would need to increase by only one during construction and no additional physicians would be needed during operation (Socio 1996a).

Local Transportation. A total of 2,809 and 1,179 vehicle trips per day would be generated during construction and operation, respectively. During construction, South Carolina State Route 230 from U.S. 25 Business at North Augusta to U.S. 1/25/78/278, a rural two lane highway, would drop from level of service from E to level of service F (Socio 1996a). Traffic generated from facility operations would not affect the level of service on the local road segments analyzed (Socio 1996a).

Subalternative Not Including Strategic Reserve and Weapons Research and Development Materials

The requirements for each storage option considered, including No Action, would decrease slightly if strategic reserve and weapons R&D materials were not included for storage at SRS. This should also result in a decrease in the number of required operation employees for each of the considered alternatives. Therefore, socioeconomic effects on the REA/ROI for the storage alternatives with no strategic reserve and weapons R&D materials should be equal to or somewhat less than the No Action Alternative, Upgrade With All or Some

RFETS and LANL Pu Subalternative, Consolidation Alternative, and the Collocation Alternative. [Text deleted.]

Phaseout

Phasing out Pu storage at SRS would result in the loss of 592 total (direct and indirect) jobs in the REA. Should all personnel be phased out at the same time, unemployment would increase to 6.9 percent and per capita income will be reduced by much less than 1 percent (Socio 1996a).

Some displaced workers may out-migrate from the ROI to seek other employment opportunities. Under the bounding case (all unemployed workers and their families leaving the ROI at the same time), population would decrease by less than 1 percent. Some of the projected ROI occupied housing units would likely become vacant as a result of population losses (Socio 1996a).

Out-migration of population during phaseout would slightly lessen the demand for community services. However, it is unlikely that communities would lower service levels unless decreased revenues made it necessary.

ROI school enrollments are projected to decrease by much less than 1 percent under the bounding case scenario. The No Action student-to-teacher ratio of 17.5:1 could be maintained if the number of teachers does not decrease from predicted No Action levels by more than 17 (Socio 1996a).

During phaseout, the number of sworn police officers could decrease by four from projected No Action levels if the No Action service level of 2.1 officers per 1,000 persons is to be maintained. The number of firefighters could decrease by five before the No Action service level of 3.0 firefighters per 1,000 persons would be affected (Socio 1996a).

Projected hospital occupancy rates during the bounding case scenario for phaseout would be slightly lower than the No Action projections. The number of physicians in the ROI could decrease by three from predicted No Action levels before the No Action service level of 3.0 physicians per 1,000 persons would be affected (Socio 1996a).

Phaseout at SRS would result in the loss of 384 vehicle trips per day. There would be minimal effects to the local road network due to this activity.

4.2.6.9 Public and Occupational Health and Safety

The assessments of potential radiological and chemical impacts associated with the storage alternatives at SRS are presented in this section. Summaries of the radiological impacts from normal operations are presented in Tables 4.2.6.9–1 and 4.2.6.9–2 for the public and workers, respectively. Impacts from hazardous chemicals are presented in Table 4.2.6.9–3. Summaries of impacts associated with postulated accidents are given in Tables 4.2.6.9–4 through 4.2.6.9–7. Detailed results are presented in Appendix M.

No Action Alternative

This section describes the radiological and hazardous chemical releases and their associated impacts resulting from normal operations involved with the SRS sitewide missions, including interim storage of Pu. The impacts to the public and to workers would be within applicable regulatory limits. For facility accidents, the risks and consequences are described in site safety documentation.

Normal Operation. The current mission at SRS, where Pu is in interim storage, is described in Section 3.7. The site has identified those facilities that will continue to operate under the No Action Alternative, including interim Pu storage facilities, the APSF, and others, if any, that will or may become operational by 2005. Based on that information, the radiological and chemical releases to the environment in 2005 and beyond (future operation) were developed and used in the impact assessments. The resulting doses and potential health effects to the public and workers at SRS are described below.

Radiological Impacts. The calculated annual dose to the average and maximally exposed members of the public from total site operation; the associated fatal cancer risks to these individuals from 50 years of operation; the dose to the population within 80 km (50 mi) from total site operation in the year 2030; and the projected number of fatal cancers in this population from 50 years of operation are presented in Table 4.2.6.9–1 under this alternative at SRS. The annual dose of 0.79 mrem to the MEI is within the radiological limits specified in NESHAPS (40 CFR 61, Subpart H) and DOE Order 5400.5. From 50 years of operation, the corresponding risk of fatal cancer to this individual would be 2.0×10^{-5} . The annual dose to the population would be within the limit in proposed 10 CFR 834 and would be 44 person-rem. The corresponding number of fatal cancers in this population from 50 years of operation would be 1.1. To put operational doses into perspective, comparisons with doses from natural background radiation are included in the table.

Under the No Action Alternative shown in Table 4.2.6.9–2, the annual average dose from total site operations to a noninvolved (No Action) site worker and the annual dose from total site operations to the noninvolved (No Action) total site workforce would be 32 mrem and 226 person-rem, respectively, as shown in Table 4.2.6.9–2. The associated risk of fatal cancer to the average worker from 50 years of total site operations would be 6.5×10^{-4} , and the potential maximum number of fatal cancers among all workers from 50 years of total site operations would be 4.5. Doses to individual workers would be kept low by instituting badged monitoring and ALARA programs and worker rotations. As a result of the implementation of these mitigation measures, the estimated number of potential latent cancer fatalities for the operation of this facility would be reduced.

Hazardous Chemical Impacts. Hazardous chemical impacts to the public resulting from the normal operation under No Action at SRS are presented in Table 4.2.6.9–3. The hazardous chemical impacts from current site operations estimate the baseline site impacts for the various storage and disposition operation alternatives. The noncancer health effects expected and the risk of cancer due to the total chemical exposures were estimated for each site. Since the major releases due to normal operation at SRS would make up nearly all of the exposures to onsite workers and to the public in adjacent communities, contributions to the hazardous chemical concentrations from all other sources (for example, industrial operations), are considered negligible for purposes of risk calculations.

Table 4.2.6.9–2. Potential Radiological Impacts to Workers During Normal Operation at Savannah River Site—Storage Alternatives

Receptor	Upgrade ^{a,b}	Consolidation ^a	Collocation ^a
Involved Workforce^c			
Average worker dose (mrem/yr) ^d	250	258	264
50-year risk of fatal cancer	5.0×10^{-3}	5.2×10^{-3}	5.3×10^{-3}
Total dose (person-rem/yr)	7.5	24	25
50-year fatal cancers	0.15	0.48	0.50
Noninvolved Workforce^e			
Average worker dose (mrem/yr) ^d	36	36	36
50-year risk of fatal cancer	7.2×10^{-4}	7.2×10^{-4}	6.5×10^{-4}
Total dose (person-rem/yr)	259	259	259
50-year fatal cancers	5.2	5.2	5.2
Total Site Workforce^f			
Dose (person-rem/yr)	266	283	284
50-year fatal cancers	5.3	5.7	5.7

^a Under the Upgrade Alternative, an estimated additional 30 involved workers would be needed if Pu is transferred from RFETS and LANL. The impacts given in the Upgrade column include those associated with these additional workers. The number of involved badged workers for the Consolidation and Collocation Alternatives would be 92 and 95, respectively.

^b The health impacts shown here assume that the upgraded storage facility at SRS would include all of the Pu materials from both RFETS and LANL. For the Preferred Alternative, the additional materials to be stored in the upgraded storage facility at SRS would only include the surplus non-pit Pu materials from RFETS. Therefore, the health impacts from the Preferred Alternative at SRS would be slightly less than the impacts presented in the Upgrade Alternative in this table. The difference would be below detection limits.

^c The involved worker is associated with operations of the proposed action. The maximum dose to an involved worker would be kept below 500 mrem per year. Based on a review of worker doses associated with similar operations (Section M.2.3.2), an average worker dose of 250 mrem per year was conservatively assumed. However, an effective ALARA program will ensure that the exposure will be reduced to that level which is as low as reasonably achievable.

^d The radiological limit for an individual worker is 5,000 mrem/year (10 CFR 835). However, DOE has also established an administrative control level of 2,000 mrem/yr (DOE 1992t); the site must make reasonable attempts to maintain worker doses below this level.

^e The noninvolved worker is onsite but not associated with operations of the proposed action. The projected number of noninvolved badged workers in 2005 is 7,199. The noninvolved workforce is equivalent to the No Action workforce in addition to a proposed 130 workers associated with future operation of the APSF.

^f The impact to the total site workforce is the summation of the involved worker impact and the noninvolved worker impact.

[Text deleted.]

Source: Section M.2.

Table 4.2.6.9-3. Potential Hazardous Chemical Impacts to the Public and Workers During Normal Operation at Savannah River Site—No Action and Storage Alternatives

Receptor	No Action	Upgrade With RFETS Non-Pit Material		Upgrade With RFETS and LANL Material		Consolidation		Collocation	
	Total Site ^a	Facility ^b	Total Site ^a	Facility ^b	Total Site ^a	Facility ^b	Total Site ^a	Facility ^b	Total Site ^a
Maximally Exposed Individual (Public)									
Hazard index ^c	5.2x10 ⁻³	1.5x10 ⁻⁶	5.2x10 ⁻³	1.6x10 ⁻⁶	5.2x10 ⁻³	2.8x10 ⁻⁶	5.2x10 ⁻³	6.2x10 ⁻⁶	5.2x10 ⁻³
Cancer risk ^d	1.3x10 ⁻⁷	0	1.3x10 ⁻⁷	0	1.3x10 ⁻⁷	7.5x10 ⁻⁹	1.4x10 ⁻⁷	7.5x10 ⁻⁹	1.4x10 ⁻⁷
Worker Onsite									
Hazard index ^e	1.2	2.1x10 ⁻⁴	1.2	2.2x10 ⁻⁴	1.2	6.0x10 ⁻⁴	1.2	1.0x10 ⁻³	1.2
Cancer risk ^f	1.9x10 ⁻⁴	0	1.9x10 ⁻⁴	0	1.9x10 ⁻⁴	1.1x10 ⁻⁵	2.1x10 ⁻⁴	1.1x10 ⁻⁵	2.0x10 ⁻⁴

^a Total=Sum of the No Action plus the contributions of the above activity.

^b Contribution from above facilities operations only. These values bound the addition of RFETS and LANL.

^c Hazard Index for MEI=Sum of individual Hazard Quotients (noncancer health effects) for MEI.

^d Cancer risk for MEI= (Emissions for 8-hr) x (0.286 [converts concentrations to doses]) x (slope factor [SF]).

^e Hazard Index for workers=Sum of individual Hazard Quotients (noncancer health effects) for workers.

^f Cancer risk for workers=(emissions for 8-hr) x (0.286 [converts concentrations to doses]) x (0.237[fraction of year exposed]) x (0.571 [fraction of lifetime working]) x (SF).

Note: Where there are no known carcinogens among the hazardous chemicals emitted, there are no slope factors, therefore the calculated cancer risk value is 0.

Source: Section M.3; Tables M.3.4-22 through M.3.4-25.

The HI to the MEI of the public at SRS resulting from normal operation under the No Action Alternative is 5.2x10⁻³, and the cancer risk is 1.3x10⁻⁷. The HI to the onsite worker is 1.2, and the cancer risk is 1.9x10⁻⁴. The HIs and cancer risks would remain constant over 50 years of operation because the exposures would be expected to remain the same.

Facility Accidents. Under the No Action Alternative, Pu would continue to be stored at the site in existing facilities. Estimates of facility accident impacts under No Action are described in the *Environmental Impact Statement, Interim Management of Nuclear Materials* for SRS (DOE/EIS-0220).²

² The EIS estimated the amount of radioactive material that could be released from the F-Canyon into the environment as a result of a severe earthquake. Using up-to-date seismic data, SRS completed a detailed evaluation of the likelihood of a severe earthquake and a structural analysis quantifying the likelihood of structural failure of F-Canyon for a range of ground motions in the *Supplemental Analysis of Seismic Activity on F-Canyon* (August 1996). Based on the evaluation, an earthquake that could occur about once every 8,000 years could cause a level of structural damage to F-Canyon similar to the level of damage attributed to the earthquake considered in the *Environmental Impact Statement, Interim Management of Nuclear Materials*. Additionally, the response spectrum associated with the 8,000-year earthquake was determined to encompass (be more severe than) the Blume response spectra. The earthquake used in the accident analysis was an event with a response spectrum (a profile of ground acceleration over a range of frequencies of motion) and peak ground acceleration as defined by J.A. Blume & Associates Engineers for SRS in the early 1980s. A frequency of occurrence (or return period) of once every 5,000 years was stated to correspond to the Blume earthquake. Thus, the capability of the F-Canyon to survive an earthquake more severe than that evaluated in the EIS, in combination with the fact that the likelihood of this level of damage was less than assumed in the EIS (1 per 8,000 years compared to 1 per 5,000 years), indicates that F-Canyon is seismically as safe, or safer, than indicated in the EIS. Two other analyses were also completed; they concluded that F-Canyon, as built, would withstand an earthquake of a magnitude of the Blume spectrum, with less damage than estimated for the EIS earthquake analysis, and that there would be no greater releases to the environment. Thus, estimates of the health effects (latent cancer fatalities) would not be greater than those described in the EIS and could be smaller than those previously analyzed in the EIS.

For the long-term storage alternatives at SRS in this PEIS, a severe earthquake was postulated with sufficient magnitude to cause major destruction of the facility. The probability of a severe earthquake and release of radioactive material was estimated at 1×10^{-7} /yr. The *Environmental Impact Statement, Interim Management of Nuclear Materials* for SRS postulates a severe earthquake with a probability of occurrence of 2×10^{-4} /yr. These two severe earthquake probabilities are not the same because of differences in the underlying assumptions and building characteristics. For example the storage facility in the Storage and Disposition PEIS would be new and designed with features to reduce the potential for earthquake damage and release of radioactive materials. The SRS facilities are not new and would react differently to an earthquake. These facilities would continue to operate in accordance with DOE Orders which ensure that the risk to the public of prompt fatalities due to accidents or cancer fatalities due to operations will be minimized. The safety to workers and the public from accidents at existing facilities is also controlled by Technical Safety Requirements specified in SARs or a Basis for Interim Operations document prepared and maintained specifically for a facility or process within a facility. Under these controls, any change in approved operations or to facilities would cause a halt in operations until it can be established that worker and public safety has not been compromised.

Upgrade Alternative

[Text deleted.]

Preferred Alternative: Upgrade With Rocky Flats Environmental Technology Site Non-Pit Plutonium Subalternative

Modify Actinide Packaging and Storage Facility for Continued Plutonium Storage

This section describes the radiological and hazardous chemical releases and their associated impacts resulting from either normal operation or accidents involved with storing SRS Pu and RFETS non-pit Pu in the upgraded APSF at SRS. The section describes the impacts of normal facility operations, then describes impacts of facility accidents.

During normal operation at SRS, the operation of the modified APSF would result in impacts that are within applicable regulatory limits, due in part to worker rotation.

Normal Operation. There would be no radiological releases during construction activities associated with the facility upgrade at SRS. Construction worker exposures to material potentially contaminated with radioactivity (for example, from construction activities involved with existing contaminated soil) would be limited to assure that doses are maintained ALARA. Toward this end, construction workers would be monitored, as appropriate. Limited hazardous chemical releases are anticipated as a result of the construction activities. However, concentrations would be within the regulated exposure limits.

Radiological Impacts. Doses to the public from storage under the Upgrade Alternative are included in Table 4.2.6.9–1. The dose to the MEI under the Preferred Alternative would be less. The dose to the MEI of the public due to annual operations under the Upgrade Alternative With RFETS Non-Pit Pu Material would be 6.8×10^{-6} mrem. From 50 years of operation, the corresponding risk of fatal cancer to this individual would be 1.7×10^{-10} . The impacts to the average individual would be less. As a result of operation under this alternative in the year 2030, the population dose would be 2.9×10^{-4} person-rem. The corresponding number of fatal cancers in this population due to 50 years of operation would be 7.2×10^{-6} . The health impacts shown here assume that the upgraded storage facility at SRS would include the Pu materials from both RFETS and LANL. Therefore, the health impacts from the Preferred Alternative at SRS (only RFETS non-pit Pu) would be slightly less than the impacts presented in the Upgrade With All or Some RFETS Pu and LANL Pu Subalternative as shown in Table 4.2.6.9–1. The difference would be below detection limits.

The dose to the MEI from annual total site operations is within the radiological limits specified in NESHAPS (40 CFR 61, Subpart H) and DOE Order 5400.5, and would be 0.79 mrem. From 50 years of total site operations, the corresponding risk of fatal cancer to this individual would be 2.0×10^{-5} . These values are presented in Table 4.2.6.9–1. The impacts on the average individual would be less. This activity would be included in a program to ensure that doses to the public are ALARA. As a result of total site operations in the year 2030, the population dose would be within the limit in proposed 10 CFR 834 and would be 44 person-rem. The corresponding number of fatal cancers in this population from 50 years of total site operations would be 1.1. The health impacts shown here assume that the upgraded storage facility at SRS would include the Pu materials from both RFETS and LANL. Therefore, the health impacts from the Preferred Alternative at SRS (only RFETS non-pit Pu) would be slightly less than the impacts presented in the Upgrade With All or Some RFETS Pu and LANL Pu Subalternative as shown in Table 4.2.6.9–1. The difference would be below detection limits.

Doses to onsite workers from normal operations are given in Table 4.2.6.9–2. Included are involved workers directly associated with the new storage facility, workers who are not involved with this facility, and the entire workforce at SRS. All doses fall within regulatory limits and administrative control levels. The associated risks and numbers of fatal cancers among the different workers from 50 years of operations are included in the table. Dose to individual workers would be kept low by instituting badged monitoring and ALARA programs and also workers rotations. As a result of the implementation of these mitigation measures, the actual number of fatal cancers calculated would be lower for the operation of this facility. The health impacts shown here assume that the upgraded storage facility at SRS would include the non-pit Pu materials from both RFETS and LANL. Therefore, the health impacts from the Preferred Alternative at SRS (only RFETS non-pit Pu) would be slightly less than the impacts presented in the Upgrade With All or Some RFETS Pu and LANL Pu Subalternative as shown in Table 4.2.6.9–2. The difference would be below detection limits.

Hazardous Chemical Impacts. Hazardous chemical impacts to the public and to the onsite worker resulting from the normal operations of the upgraded storage facilities at SRS are presented in Table 4.2.6.9–3. The impacts from all site operations, including the upgraded storage facilities are also included in this table. Total site impacts which include the No Action impact plus the upgrade facility impacts, are provided. All analyses to support the values presented in this table are provided in Section M.3.

The HI to the MEI of the public is 1.5×10^{-6} , and the cancer risk is zero (because no carcinogens are released from the hazardous chemicals used) as a result of operation of the upgraded storage facilities in the year 2030. The HI and cancer risk would remain constant over 50 years of operation, because exposures would be expected to remain the same. The total site operation, including the upgrade facility, would result in an HI of 5.2×10^{-3} and a cancer risk of 1.3×10^{-7} for the MEI in the year 2030. This would be expected to remain constant as a result of 50 years of operation.

The HI to the onsite worker would be 2.1×10^{-4} and the cancer risk is zero (because no carcinogens are released from the hazardous chemicals used) as a result of operation of the upgraded storage facilities in the year 2030. The HI and cancer risk from hazardous chemicals would remain constant over 50 years of operation, because exposures would be expected to remain the same. The total site operation, including the upgrade facility, would result in a HI of 1.2 and a cancer risk of 1.9×10^{-4} for the onsite worker in the year 2030 and would be expected to remain constant as a result of 50 years of operation. The HI to the worker resulting from operation of the upgraded storage facilities at SRS may exceed the acceptable health regulatory level. The total site HI of 1.2 is a screening level value which does not necessarily mean that workers will incur hazardous health effects. Moreover, since one of the assumptions used in the ISCST2 model to calculate HI is that the entire emissions inventory is from a single stack and all emissions impact the onsite worker, it may overstate the actual conditions being analyzed. This would be true at a large site, like SRS, where emission sources and receptors are widely dispersed, over 830 km² (320 mi²), and the primary contributor to the HI is CO which is not concentrated in any single emissions stack.

Facility Accidents. Under this upgrade subalternative, non-pit Pu from RFETS would be stored at SRS in a modified APSF. The modified APSF facility is expected to result in a reduced risk of accidents to workers and the public. Design modifications to the storage facility will ensure that the continued storage of Pu will be in accordance with contemporary DOE Orders, and that the risks to the public of prompt fatalities due to accidents and of latent cancer fatalities due to operations would be minimized as shown in Table 4.2.6.9–4. The safety of workers and the public during operations is routinely controlled and monitored through Technical Safety Requirements that are specified in approved safety analyses that would be prepared and implemented for the upgraded facilities.

A set of potential accidents have been postulated for upgraded Pu storage with RFETS non-pit Pu at SRS for which there may be releases of Pu that may impact onsite workers and the offsite population. The accident consequences and risks to a worker located 1,000 m (3,280 ft) from the accident release point, the maximum offsite individual located at the site boundary, and the population located within 80 km (50 mi) of the accident release point are summarized in Table 4.2.6.9–4. For the set of accidents analyzed, the maximum number of cancer fatalities in the population with 80 km (50 mi) would be 0.098 at SRS for the beyond design basis earthquake accident with an estimated probability of 1.0×10^{-7} per year (that is, possibility of severe earthquake occurring is estimated to be about 1.0×10^{-5} , once in 100,000 years, multiplied by a damage and release probability of 0.01). The corresponding 50-year facility lifetime risk from the same accident scenario for the population, maximum offsite individual, and worker at 1,000 m (3,280 ft), would be 4.9×10^{-7} , 9.8×10^{-11} , and 5.0×10^{-9} , respectively. The maximum population 50-year facility lifetime risk would be 4.6×10^{-4} (that is, one fatality in about 100,000) at SRS for the PCV penetration by corrosion accident scenario with a probability of 4.8×10^{-3} per year. The corresponding maximum offsite individual and worker 50-year facility lifetime risks would be 7.0×10^{-8} and 2.9×10^{-6} , respectively. Section M.5 presents additional facility accident data and summary descriptions of the accident scenarios identified in Table 4.2.6.9–4.

Involved workers, those that would work in the facilities associated with the proposed action, may be subject to injury and, in some cases, fatality as a result of potential accidents. The locations of workstations, number of workers, personnel protective features, engineered safety features, and other design details affect the extent of worker exposures to accidents. Certain accidents such as fires, explosions and criticality could cause fatalities to workers close to the accident. Prior to construction of a new or modification of an existing facility, DOE Orders require detailed safety analyses to assure that facility designs and operating procedures limit the number of workers in hazardous areas and minimize risk of injury or fatality in the event of an accident.

[Text deleted.]

Upgrade With All or Some Rocky Flats Environmental Technology Site Plutonium and Los Alamos National Laboratory Plutonium Subalternative

Modify Actinide Packaging and Storage Facility for Continued Plutonium Storage

Normal Operation. The impacts from radiological and hazardous chemical emissions would be slightly greater than the impacts for the Upgrade With RFETS Non-Pit Pu Subalternative. The difference would be below detection limits. The radiological dose to the public and workers are shown in Tables 4.2.6.9–1 and 4.2.6.9–2, respectively. Impacts from hazardous chemicals are given in Table 4.2.6.9–3.

Facility Accidents. Under the Upgrade Alternative, Pu from RFETS and LANL would be stored at SRS. The upgraded facility is expected to result in a reduced risk of accidents to workers and the public. Design modifications to the storage facility will ensure that the storage of Pu will be in accordance with contemporary DOE Orders, and that the risks to the public of prompt fatalities due to accidents and of latent cancer fatalities due to operations would be minimized as shown in Table 4.2.6.9–5. The safety of workers and the public during operations is routinely controlled and monitored through Technical Safety Requirements that are specified in approved safety analyses that would be prepared and implemented for the upgraded facilities.

Table 4.2.6.9–4. Upgrade With Rocky Flats Environmental Technology Site Non-Pit Plutonium Subalternative—Accident Impacts at Savannah River Site

Accident Description	Worker at 1,000 m		Maximum Offsite Individual		Population to 80 km		Accident Frequency (per yr)
	Risk of Cancer Fatality (per 50 yr) ^a	Probability of Cancer Fatality ^b	Risk of Cancer Fatality (per 50 yr) ^a	Probability of Cancer Fatality ^b	Risk of Cancer Fatality (per 50 yr) ^a	Number of Cancer Fatalities ^c	
PCV puncture by forklift	8.6×10^{-8}	2.9×10^{-6}	2.1×10^{-9}	7.1×10^{-8}	1.0×10^{-5}	3.4×10^{-4}	6.0×10^{-4}
PCV breach by firearms discharge	5.0×10^{-9}	2.9×10^{-7}	1.2×10^{-10}	7.1×10^{-9}	6.0×10^{-7}	3.4×10^{-5}	3.5×10^{-4}
PCV penetration by corrosion	2.9×10^{-6}	1.2×10^{-5}	7.0×10^{-8}	2.9×10^{-7}	3.4×10^{-4}	1.4×10^{-3}	4.8×10^{-3}
Vault fire	2.6×10^{-9}	5.2×10^{-4}	5.6×10^{-11}	1.1×10^{-5}	2.7×10^{-7}	0.054	1.0×10^{-7}
Truck bay fire	2.0×10^{-9}	4.0×10^{-4}	4.9×10^{-11}	9.9×10^{-5}	2.4×10^{-7}	0.048	1.0×10^{-7}
Spontaneous combustion	2.0×10^{-11}	5.8×10^{-7}	5.0×10^{-13}	1.4×10^{-8}	2.4×10^{-9}	6.9×10^{-5}	7.0×10^{-7}
Explosion in the vault	3.5×10^{-10}	7.1×10^{-5}	9.0×10^{-12}	1.7×10^{-6}	4.2×10^{-8}	8.3×10^{-3}	1.0×10^{-7}
Explosion outside of vault	2.2×10^{-11}	4.3×10^{-6}	5.3×10^{-13}	1.5×10^{-7}	2.6×10^{-9}	5.1×10^{-4}	1.0×10^{-7}
Nuclear criticality	1.4×10^{-11}	2.8×10^{-6}	2.8×10^{-13}	5.7×10^{-8}	2.3×10^{-10}	4.7×10^{-5}	1.0×10^{-7}
Beyond evaluation basis earthquake	5.0×10^{-9}	9.8×10^{-4}	9.8×10^{-11}	2.0×10^{-5}	4.9×10^{-7}	0.098	1.0×10^{-7}
Expected risk ^d	3.0×10^{-6}	–	7.2×10^{-8}	–	3.5×10^{-4}	–	–

^a The risk values are calculated by multiplying the probability of cancer fatality (for the worker at 1,000 m or the maximum offsite individual) or the number of cancer fatalities (for the population to 80 km) by the accident frequency and the number of years of operation.

^b Increased likelihood (or probability) of cancer fatality to a hypothetical individual (a single worker at a distance of 1,000 m or the site boundary, whichever is smaller, or to a hypothetical individual in the offsite population located at the site boundary) if exposed to the indicated dose. The value assumes the accident has occurred.

^c Estimated number of cancer fatalities in the entire offsite population out to a distance of 80 km if exposed to the indicated dose. The value assumes the accident has occurred.

^d Expected risk is the sum of the risks over the 50-year lifetime of the facility.

Note: All values are mean values.

Source: Calculated using the source terms in Tables M.5.2.1.1–4 and M.5.2.1.1–5 and the MACCS computer code.

Involved workers, those that would work in the facilities associated with the proposed action, may be subject to injury and, in some cases, fatality as a result of potential accidents. The locations of workstations, number of workers, personnel protective features, engineered safety features, and other design details affect the extent of worker exposures to accidents. Certain accidents such as fires, explosions and criticality could cause fatalities to workers close to the accident. Prior to construction of a new or modification of an existing facility, DOE Orders require detailed safety analyses to assure that facility designs and operating procedures limit the number of workers in hazardous areas and minimize risk of injury or fatality in the event of an accident.

Consolidation Alternative

Construct New Plutonium Storage Facility

This section includes a description of radiological and hazardous chemical releases and their associated impacts resulting from either normal operation or accidents involved with the construction and operation of the new consolidated Pu storage facility at SRS.

Table 4.2.6.9–4. Upgrade With All or Some Rocky Flats Environmental Technology Site Plutonium and Los Alamos National Laboratory Plutonium Subalternative—Accident Impacts at Savannah River Site

Accident Description	Worker at 1,000 m		Maximum Offsite Individual		Population to 80 km		Accident Frequency (per year)
	Risk of Cancer Fatality (per 50 yr) ^a	Probability of Cancer Fatality ^b	Risk of Cancer Fatality (per 50 yr) ^a	Probability of Cancer Fatality ^a	Risk of Cancer Fatality (per 50 yr) ^a	Number of Cancer Fatalities ^c	
PCV puncture by forklift	8.6×10^{-8}	2.9×10^{-6}	2.1×10^{-9}	7.1×10^{-8}	1.0×10^{-5}	3.4×10^{-4}	6.0×10^{-4}
PCV breach by firearms discharge	5.0×10^{-9}	2.9×10^{-7}	1.2×10^{-10}	7.1×10^{-9}	6.0×10^{-7}	3.4×10^{-5}	3.5×10^{-4}
PCV penetration by corrosion	3.9×10^{-6}	1.2×10^{-5}	9.5×10^{-8}	2.9×10^{-7}	4.6×10^{-4}	1.4×10^{-3}	6.6×10^{-3}
Vault fire	3.5×10^{-9}	7.1×10^{-4}	7.6×10^{-11}	1.5×10^{-5}	3.7×10^{-7}	0.072	1.0×10^{-7}
Truck bay fire	2.0×10^{-9}	4.0×10^{-4}	4.9×10^{-11}	9.9×10^{-6}	2.4×10^{-7}	0.048	1.0×10^{-7}
Spontaneous combustion	2.0×10^{-11}	5.8×10^{-7}	5.0×10^{-13}	1.4×10^{-8}	2.4×10^{-9}	6.9×10^{-5}	7.0×10^{-7}
Explosion in the vault	4.8×10^{-10}	9.6×10^{-5}	1.2×10^{-11}	2.4×10^{-6}	5.7×10^{-8}	0.011	1.0×10^{-7}
Explosion outside of vault	2.2×10^{-11}	4.3×10^{-6}	5.3×10^{-13}	1.5×10^{-7}	2.6×10^{-9}	5.1×10^{-4}	1.0×10^{-7}
Nuclear criticality	1.4×10^{-11}	2.8×10^{-6}	2.8×10^{-13}	5.7×10^{-8}	2.3×10^{-10}	4.7×10^{-5}	1.0×10^{-7}
Beyond evaluation basis earthquake	6.9×10^{-9}	1.3×10^{-3}	1.3×10^{-10}	2.8×10^{-5}	6.7×10^{-7}	0.13	1.0×10^{-7}
Expected risk ^d	3.9×10^{-6}	—	9.7×10^{-8}	—	4.7×10^{-4}	—	—

^a The risk values are calculated by multiplying the probability of cancer fatality (for the worker at 1,000 m or the maximum offsite individual) or the number of cancer fatalities (for the population to 80 km) by the accident frequency and the number of years of operation. Impacts not dependent on the quantity of Pu would be the same as those for the Upgrade With RFETS Non-Pit Pu Subalternative.

^b Increased likelihood (or probability) of cancer fatality to a hypothetical individual (a single worker at a distance of 1,000 m or the site boundary, whichever is smaller, or to a hypothetical individual in the offsite population located at the site boundary) if exposed to the indicated dose. The value assumes the accident has occurred.

^c Estimated number of cancer fatalities in the entire offsite population out to a distance of 80 km if exposed to the indicated dose. The value assumes the accident has occurred.

^d Expected risk is the sum of the risks over the 50-year lifetime of the facility.

Note: All values are mean values.

Source: Calculated using the source terms in Tables M.5.2.1.1–4 and M.5.2.1.1–5 and the MACCS computer code.

[Text deleted.]

Normal Operation. There would be no radiological releases during the construction of a new consolidated Pu storage facility at SRS. Construction worker exposures to material potentially contaminated with radioactivity (for example, from construction activities involved with existing contaminated soil) would be limited to assure that doses are maintained ALARA. Toward this end, construction workers would be monitored as appropriate. Limited hazardous chemical releases are anticipated as a result of construction activities. However, concentrations would be within the regulated exposure limits and would not result in any health effects. During normal operation, there would be both radiological and hazardous chemical releases to the environment and also direct in-plant exposures. The resulting doses and potential health effects to the public and workers at SRS are described below.

Radiological Impacts. Radiological impacts to the public resulting from the normal operation of the new consolidated Pu storage facility are presented in Table 4.2.6.9–1. The impact from all site operations, including

the new consolidated storage facility, are also given in the table. To put operational doses into perspective, comparisons with doses from natural background radiation are included in the table.

The dose to the MEI from annual storage facility operation would be 1.4×10^{-5} mrem. From 50 years of operation, the corresponding risk of fatal cancer to this individual would be 3.5×10^{-10} . The impacts to the average member of the public would be less. As a result of storage facility operation in the year 2030, the population dose would be 9.2×10^{-4} person-rem. The corresponding number of fatal cancers in this population from 50 years of operation would be 2.3×10^{-5} .

The dose to the MEI from annual total site operations is within the radiological limits specified in NESHAPS (40 CFR 61, Subpart H) and DOE Order 5400.5, and would be 0.79 mrem. From 50 years of operation, the corresponding risk of fatal cancer to this individual would be 2.0×10^{-5} . The impacts to the average member of the public would be less. This activity would be included in a program to ensure that doses to the public are ALARA. As a result of total site operations in the year 2030, the population dose would be within the limit in proposed 10 CFR 834 and would be 44 person-rem. The corresponding number of fatal cancers in this population from 50 years of operation would be 1.1.

Doses to onsite workers from normal operations are given in Table 4.2.6.9–2. Included are involved workers directly associated with the new consolidated Pu storage facility, workers who are not involved with the storage facility, and the entire workforce at SRS. All doses fall within regulatory limits and administrative control levels. The associated risks and number of fatal cancers among the different workers from 50 years of operation are included in the table. Dose to individual workers would be kept low by instituting badged monitoring and ALARA programs and also workers rotations. As a result of the implementation of these mitigation measures, the actual number of fatal cancers calculated would be lower for the operation of this facility.

Hazardous Chemical Impacts. Hazardous chemical impacts to the public and to the onsite worker resulting from the normal operations of the new consolidated Pu storage facility at SRS are presented in Table 4.2.6.9–3. The impacts from all site operations, including the consolidated storage facility, are also included in this table. Total site impacts, which include the No Action impact plus the facility impacts, are provided. All analyses to support the values presented in this table are provided in Section M.3.

The HI to the MEI of the public is 2.8×10^{-6} , and the cancer risk is 7.5×10^{-9} as a result of operation of the new consolidated Pu storage facility in the year 2030. The HI and cancer risk from hazardous chemicals would remain constant over 50 years of operation, because exposures would be expected to remain the same. The total site operation, including the upgrade facility, would result in an HI of 5.2×10^{-3} and a cancer risk of 1.4×10^{-7} for the MEI in the year 2030. This would be expected to remain constant over the 50 years of operation.

The HI to the onsite worker would be 6.0×10^{-4} and the cancer risk is 1.1×10^{-5} as a result of operation of the new consolidated Pu storage facility in the year 2030. The HI and cancer risk from hazardous chemicals would remain constant over 50 years of operation, because exposures would be expected to remain the same. The total site operation, including the facility, would result in a HI of 1.2 and a cancer risk of 2.1×10^{-4} for the onsite worker in the year 2030 and would be expected to remain constant over the 50 years of operation.

Facility Accidents. A set of potential accidents have been postulated for consolidation of Pu at SRS for which there may be releases of Pu that may impact onsite workers and the offsite population. The accident consequences and risks to a worker located 1,000 m (3,280 ft) from the accident release point, the maximum offsite individual located at the site boundary, and the general population located within 80 km (50 mi) of the accident release point are summarized in Table 4.2.6.9–6. For the set of accidents analyzed, the maximum number of cancer fatalities in the population within 80 km (50 mi) would be 1.3 at SRS for the beyond design basis earthquake accident with an estimated probability of 1.0×10^{-7} per year (that is, probability of severe earthquake occurring is estimated to be about 1.0×10^{-5} , once in 100,000 years, multiplied by a damage and release probability of 0.01). The corresponding 50-year facility lifetime risk from the same accident scenario

Table 4.2.6.9–6. Consolidation Alternative Accident Impacts at Savannah River Site

Accident Description	Worker at 1,000 m		Maximum Offsite Individual		Population to 80 km		Accident Frequency (per yr)
	Risk of Cancer Fatality (per 50 yr) ^a	Probability of Cancer Fatality ^b	Risk of Cancer Fatality (per 50 yr) ^a	Probability of Cancer Fatality ^b	Risk of Cancer Fatalities (per 50 yr) ^a	Number of Cancer Fatalities ^c	
PCV puncture by forklift	8.6×10^{-8}	2.9×10^{-6}	2.1×10^{-9}	7.1×10^{-8}	1.0×10^{-5}	3.4×10^{-4}	6.0×10^{-4}
PCV breach by firearms discharge	5.0×10^{-9}	2.9×10^{-7}	1.2×10^{-10}	7.1×10^{-9}	6.0×10^{-7}	3.4×10^{-5}	3.5×10^{-4}
PCV penetration by corrosion	3.8×10^{-5}	1.2×10^{-5}	9.3×10^{-7}	2.9×10^{-7}	4.5×10^{-3}	1.4×10^{-3}	0.064
Vault fire	3.4×10^{-8}	6.9×10^{-3}	7.4×10^{-10}	1.5×10^{-4}	3.6×10^{-6}	0.72	1.0×10^{-7}
Truck bay fire	2.0×10^{-9}	4.0×10^{-4}	4.9×10^{-11}	9.9×10^{-6}	2.4×10^{-7}	0.048	1.0×10^{-7}
Spontaneous combustion	2.0×10^{-11}	5.8×10^{-7}	5.0×10^{-13}	1.4×10^{-8}	2.4×10^{-9}	6.9×10^{-5}	7.0×10^{-7}
Explosion in the vault	4.7×10^{-9}	9.4×10^{-4}	1.2×10^{-10}	2.3×10^{-5}	5.6×10^{-7}	0.11	1.0×10^{-7}
Explosion outside of vault	2.2×10^{-11}	4.3×10^{-6}	5.3×10^{-13}	1.1×10^{-7}	2.6×10^{-9}	5.1×10^{-4}	1.0×10^{-7}
Nuclear criticality	1.4×10^{-11}	2.8×10^{-6}	2.8×10^{-13}	5.7×10^{-8}	2.3×10^{-10}	4.7×10^{-5}	1.0×10^{-7}
Beyond evaluation basis earthquake	6.7×10^{-8}	0.013	1.3×10^{-9}	2.7×10^{-4}	6.5×10^{-6}	1.3	1.0×10^{-7}
Expected risk ^d	3.8×10^{-5}	–	9.3×10^{-7}	–	4.5×10^{-3}	–	–

^a The risk values are calculated by multiplying the probability of cancer fatality (for the worker at 1,000 m or the maximum offsite individual) or the number of cancer fatalities (for the population to 80 km) by the accident frequency and the number of years of operation.

^b Increased likelihood (or probability) of cancer fatality to a hypothetical individual (a single onsite worker at a distance of 1,000 m or the site boundary, whichever is smaller or to a hypothetical individual in the offsite population located at the site boundary) if exposed to the indicated dose. The value assumes the accident has occurred.

^c Estimated number of cancer fatalities in the entire offsite population out to a distance of 80 km if exposed to the indicated dose. The value assumes the accident has occurred.

^d Expected risk is the sum of the risks over the 50-year lifetime of the facility.

Note: All values are mean values.

Source: Calculated using the source terms in Tables M.5.2.1.1–4 and M.5.2.1.1–5 and the MACCS computer code.

for the population, maximum offsite individual, and worker at 1,000 m (3,280 ft), would be 6.5×10^{-6} , 1.3×10^{-9} , and 6.7×10^{-8} , respectively. The maximum population 50-year facility lifetime risk would be 4.5×10^{-3} (that is, one fatality in about 10,000 years) at SRS for the PCV penetration by corrosion accident scenario with a probability of 0.064 per year. The corresponding maximum offsite individual and worker 50-year facility lifetime risks would be 9.3×10^{-7} and 3.8×10^{-5} , respectively. Section M.5 presents additional facility accident data and summary descriptions of the accident scenarios identified in Table 4.2.6.9–6.

Involved workers, those that would work in the facilities associated with the proposed action, may be subject to injury and, in some cases, fatality as a result of potential accidents. The locations of workstations, number of workers, personnel protective features, engineered safety features, and other design details affect the extent of worker exposures to accidents. Certain accidents such as fires, explosions and criticality could cause fatalities to workers close to the accident. Prior to construction of a new facility, DOE Orders require detailed safety analyses to assure that facility designs and operating procedures limit the number of workers in hazardous areas and minimize risk of injury or fatality in the event of an accident.

Collocation Alternative

Construct New Plutonium and Highly Enriched Uranium Storage Facilities

This section includes a description of radiological and hazardous chemical releases and their associated impacts resulting from either normal operation or accidents involved with the consolidation of Pu storage and collocation with HEU storage facilities at SRS. This storage would take place in a new Pu and HEU storage facility.

[Text deleted.]

Normal Operation. There would be no radiological releases during the construction of a new collocated storage facility at SRS. Construction worker exposures to material potentially contaminated with radioactivity (for example, from construction activities involved with existing contaminated soil) would be limited to assure that doses are maintained ALARA. Toward this end, construction workers would be monitored, as appropriate. Limited hazardous chemical releases are anticipated as a result of construction activities. However, concentrations would be within the regulated exposure limits. During normal operation, there would be both radiological and hazardous chemical releases to the environment and also direct in-plant exposures. The resulting doses and potential health effects to the public and workers are described below.

Radiological Impacts. Radiological impacts to the public resulting from the normal operation of the new collocated storage facility at SRS are presented in Table 4.2.6.9-1. The impacts from all site operations, including the new storage facility, are also given in the table. To put operational doses into perspective, comparisons with doses from natural background radiation are included in the table.

The dose to the MEI from annual storage facility operation is 1.4×10^{-5} mrem. From 50 years of operation, the corresponding risk of fatal cancer to this individual would be 3.5×10^{-10} . The impacts to the average member of the public would be less. As a result of storage facility operation in the year 2030, the population dose would be 8.8×10^{-4} person-rem. The corresponding number of fatal cancers in this population from 50 years of operation would be 2.2×10^{-5} .

The dose to the MEI from annual total site operations is within the radiological limits specified in NESHAPS (40 CFR 61, Subpart H) and DOE Order 5400.5, and would be 0.79 mrem. From 50 years of operation, the corresponding risk of fatal cancer to this individual would be 2.0×10^{-5} . The impacts to the average member of the public would be less. This activity would be included in a program to ensure that doses to the public are ALARA. As a result of total site operation in the year 2030, the population dose would be within the limit in proposed 10 CFR 834 and would be 44 person-rem. The corresponding number of fatal cancers in this population from 50 years of operation would be 1.1.

Doses to onsite workers from normal operations are given in Table 4.2.6.9-2. Included are involved workers directly associated with the new storage facility, workers who are not involved with the storage facility, and the entire workforce at SRS. All doses fall within regulatory limits and administrative control levels. The associated risks and numbers of fatal cancers among the different workers from 50 years of operations are included in the table. Dose to individual workers would be kept low by instituting badged monitoring and ALARA programs and also workers rotations. As a result of the implementation of these mitigation measures, the actual number of fatal cancers calculated would be lower for the operation of the facility.

Hazardous Chemical Impacts. Hazardous chemical impacts to the public and to the onsite worker resulting from the normal operations of the new consolidation of Pu and collocation with HEU storage facilities at SRS are presented in Table 4.2.6.9-3. The impacts from all site operations, including the consolidation of Pu and collocation with HEU storage facilities are also included in this table. Total site impacts, which include the No

Action impact plus the facility impacts, are provided. All analyses to support the values presented in this table are provided in Section M.3.

The HI to the MEI of the public is 6.2×10^{-6} , and the cancer risk is 7.5×10^{-9} as a result of operation of the new consolidation of Pu and collocation with HEU storage facilities in the year 2030. The HI and cancer risk from hazardous chemicals would remain constant over 50 years of operation, because exposures would be expected to remain the same. The total site operation, including the new facility, would result in an HI of 5.2×10^{-3} and a cancer risk of 1.4×10^{-7} for the onsite worker in the year 2030. This would be expected to remain constant as a result of 50 years of operation.

The HI to the onsite worker would be 1.0×10^{-3} , and the cancer risk is 1.1×10^{-5} as a result of operation of the new consolidation of Pu and collocation with HEU storage facilities in the year 2030. The HI and cancer risk from hazardous chemicals would remain constant over 50 years of operation, because exposures would be expected to remain the same. The total site operation, including the new facility, would result in an HI of 1.2 and a cancer risk of 2.0×10^{-4} for the onsite worker in the year 2030 and would be expected to remain constant as a result of 50 years of operation.

Facility Accidents. A set of potential accidents have been postulated for which there may be releases of Pu or uranium that may impact onsite workers and the offsite population. Impacts of accidents that release both Pu and HEU are bounded by exposures to Pu. The accident consequences and risks to a worker located 1,000 m (3,280 ft) from the accident release point, the maximum offsite individual located at the site boundary, and the general population located within 80 km (50 mi) of the accident release point are summarized in Table 4.2.6.9–7. For the set of accidents analyzed, the maximum number of cancer fatalities in the population within 80 km (50 mi) would be 1.3 at SRS for the beyond design basis earthquake accident scenario with an estimated probability of 1.0×10^{-7} per year (that is, probability of severe earthquake occurring is estimated to be about 1.0×10^{-5} , once in 100,000 years, multiplied by a damage and release probability of 0.01). The corresponding 50-year facility lifetime risk from the same accident scenario for the population, maximum offsite individual, and worker at 1,000 m (3,280 ft), would be 6.6×10^{-6} , 9.2×10^{-10} , and 6.7×10^{-8} , respectively. The maximum population 50-year facility lifetime risk would be 4.6×10^{-3} (that is, one fatality in about 11,000 years) at SRS for the PCV penetration by corrosion accident scenario with a probability of 0.064 per year. The corresponding maximum offsite individual and worker 50-year facility lifetime risks would be 6.3×10^{-7} and 3.8×10^{-5} , respectively. Section M.5 presents additional facility accident data and summary descriptions of the accident scenarios identified in Table 4.2.6.9–7.

Involved workers, those that would work in the facilities associated with the proposed action, may be subject to injury and, in some cases, fatality as a result of potential accidents. [Text deleted.] The locations of workstations, number of workers, personnel protective features, engineered safety features, and other design details affect the extent of worker exposures to accidents. Certain accidents such as fires, explosions, and criticality could cause fatalities to workers close to the accident. Prior to construction and operation of the facility, DOE Orders require detailed safety analyses to assure that facility designs and operating procedures limit the number of workers in hazardous areas and minimize risk of injury or fatality in the event of an accident.

Subalternative Not Including Strategic Reserve and Weapons Research and Development Materials

If the strategic reserve and weapons R&D materials are not included, the impacts to the public and to workers from the accident-free storage activities would be reduced approximately in proportion to the decrease in the amount of material stored. The impacts from total site operations would decrease slightly. This subalternative applies to the No Action Alternative, the Upgrade Alternative, the Consolidation Alternative, and the Collocation Alternative. The risks due to accidents would also tend to be lower.

Table 4.2.6.9–7. Collocation Alternative Accident Impacts at Savannah River Site

Accident Description	Worker at 1,000 m		Maximum Offsite Individual		Population to 80 km		Accident Frequency (per yr)
	Risk of Cancer Fatality (per 50 yr) ^a	Probability of Cancer Fatality ^b	Risk of Cancer Fatality (per 50 yr) ^a	Probability of Cancer Fatality ^b	Risk of Cancer Fatalities (per 50 yr) ^a	Number of Cancer Fatalities ^c	
PCV puncture by forklift	8.6×10^{-8}	2.9×10^{-6}	1.4×10^{-9}	4.8×10^{-8}	1.0×10^{-5}	3.5×10^{-4}	6.0×10^{-4}
PCV breach by firearms discharge	5.0×10^{-9}	2.9×10^{-7}	1.5×10^{-11}	4.8×10^{-9}	6.1×10^{-7}	3.5×10^{-5}	3.5×10^{-4}
PCV penetration by corrosion	3.8×10^{-5}	1.2×10^{-5}	6.3×10^{-7}	2.0×10^{-7}	4.6×10^{-3}	1.4×10^{-3}	0.064
Vault fire	3.4×10^{-8}	6.9×10^{-3}	5.1×10^{-10}	1.0×10^{-4}	3.7×10^{-6}	0.73	1.0×10^{-7}
Truck bay fire	2.0×10^{-9}	4.0×10^{-4}	3.4×10^{-11}	6.7×10^{-6}	2.4×10^{-7}	0.049	1.0×10^{-7}
Spontaneous combustion	2.0×10^{-11}	5.8×10^{-7}	3.4×10^{-13}	9.7×10^{-9}	2.5×10^{-9}	7.0×10^{-5}	7.0×10^{-7}
Explosion in the vault	4.7×10^{-9}	9.4×10^{-4}	7.9×10^{-11}	1.6×10^{-5}	5.8×10^{-7}	0.12	1.0×10^{-7}
Explosion outside the vault	2.2×10^{-11}	4.3×10^{-6}	3.6×10^{-13}	7.3×10^{-8}	2.6×10^{-9}	5.2×10^{-4}	1.0×10^{-7}
Nuclear criticality	1.4×10^{-11}	2.8×10^{-6}	1.8×10^{-13}	3.5×10^{-8}	2.2×10^{-10}	4.4×10^{-5}	1.0×10^{-7}
Beyond evaluation basis earthquake	6.7×10^{-8}	0.013	9.2×10^{-10}	1.8×10^{-4}	6.6×10^{-6}	1.3	1.0×10^{-7}
Expected risk ^d	3.8×10^{-5}	–	6.4×10^{-7}	–	4.6×10^{-3}	–	–

^a The risk values are calculated by multiplying the probability of cancer fatality (for the worker at 1,000 m or the maximum offsite individual) or the number of cancer fatalities (for the population to 80 km) by the accident frequency and the number of years of operation.

^b Increased likelihood (or probability) of cancer fatality to a hypothetical individual (a single onsite worker at a distance of 1,000 m or the site boundary, whichever is smaller or to a hypothetical individual in the offsite population located at the site boundary) if exposed to the indicated dose. The value assumes the accident has occurred.

^c Estimated number of cancer fatalities in the entire offsite population out to a distance of 80 km if exposed to the indicated dose. The value assumes the accident has occurred.

^d Expected risk is the sum of the risks over the 50-year lifetime of the facility.

Note: All values are mean values.

Source: Calculated using the source terms in Tables M.5.2.2.1–3 and M.5.2.2.1–4 and the MACCS computer code.

Phaseout

Normal Operation. A phaseout of existing Pu storage facilities at SRS would reduce the impacts from radiological and chemical releases and exposures to levels slightly below the No Action levels. All workers involved in the transfer of the Pu from existing storage would be monitored to assure that their doses remain within regulatory limits and as low as reasonably achievable.

Facility Accidents. The phaseout operation will be conducted in accordance with DOE Orders to ensure that the risk to the public of prompt fatalities due to accidents or of cancer fatalities due to operations will be minimized. For current operations in the facility that would be phased out, the safety of workers and the public from accidents is controlled by Technical Safety Requirements that are specified in SARs or Basis for Interim Operations documents that have been prepared for the facility. Prior to initiating phaseout, the potential for accidents that could impact workers and the public will be assessed, and if necessary, applicable existing safety documentations will be modified to ensure safety for workers and the public.

4.2.6.10 Waste Management

This section summarizes the impacts on waste management at SRS under No Action, for each of the long-term storage alternatives, and for the phaseout of Pu storage. There is no spent nuclear fuel or HLW associated with Pu or HEU storage. Table 4.2.6.10–1 lists the projected sitewide waste generation rates and treatment, storage, disposal capacities under No Action for 2005. Projections for No Action were derived from the most recent available environmental data, with the appropriate adjustments made for those changing operational requirements where the volume of wastes generated were identifiable. The projection does not include wastes from future, yet uncharacterized, environmental restoration activities. The projections for No Action could change significantly depending on the decisions resulting from the PEIS being prepared by the Department on waste management. Table 4.2.6.10–2 provides the estimated incremental operational waste volumes projected to be generated at SRS as a result of the various storage alternatives prior to treatment. Some of the waste values described in this section are different than the waste values in the table. For those values that differ (for example LLW), the table gives waste generated pre-treatment values and the text discusses post-treatment values (indicated as after treatment and volume reduction). For example, the new consolidated Pu storage facility would generate 10 m³ (13 yd³) of solid TRU waste. Since SRS already stores Pu, the waste volumes associated with the phaseout of Pu storage (8 m³ [10.5 yd³]) must be subtracted out to avoid double counting waste volumes associated with Pu storage. This results in a net incremental increase from the alternative of 2 m³ (2.6 yd³). The subtraction of the phaseout volumes to avoid the double counting of waste volumes is only applicable to the consolidation and collocation alternatives. The waste volumes generated from the various storage alternatives and the resultant waste effluent used for the waste impact analysis can be found in Section E.3.1. For the consolidation and collocation alternatives, the waste effluent volumes in the impact analysis refer only to wastes from the applicable storage facility, not the net incremental increase/decrease for SRS as a whole. Facilities that would support the storage of Pu and/or HEU would treat and package all waste generated into forms that would enable staging and/or disposal in accordance with RCRA, and other applicable statutes. Depending on decisions in waste-type-specific RODs for the Waste Management PEIS, wastes could be treated, and depending on the type of waste disposed of onsite or at regionalized or centralized DOE sites. For the purposes of analyses only, this PEIS assumes that TRU and mixed TRU waste would be treated onsite to the current planning-basis WIPP WAC, and shipped to WIPP for disposal. This PEIS also assumes that LLW, mixed LLW, hazardous, and nonhazardous waste would be treated and disposed of in accordance with current site practice.

No Action Alternative

Under No Action, high-level, TRU, low-level, mixed, hazardous, and nonhazardous wastes, and spent nuclear fuel would continue to be managed from the missions outlined in Section 3.7. SRS's mission would include tritium recycling, management of nuclear materials, isotopes, and aluminum-clad and research reactor spent fuel, decommissioning of reactors and site facilities, and remediation. Under No Action, SRS would continue to store its inventory of Pu, and treat, store, and dispose of its legacy and newly generated wastes in current and planned facilities.

Under No Action, the processing of legacy wastes would require new facilities, since the necessary treatment, storage, and disposal facilities either do not exist or are nearing capacity. Spent nuclear fuel would be managed in accordance with the ROD (60 FR 28680) from the *Department of Energy Programmatic Spent Nuclear Fuel Management and Idaho National Engineering Laboratory Environmental Restoration and Waste Management Programs Final Environmental Impact Statement* (DOE/EIS-0203-F) as amended on March 8, 1996 (61 FR 9441) and the ROD from the *Proposed Nuclear Weapons Nonproliferation Policy Concerning Foreign Research Reactor Spent Nuclear Fuel Final Environmental Impact Statement* (61 FR 25092), which state that SRS would be responsible for the management of aluminum-clad spent nuclear fuel from the Department's nationwide complex, as well as receiving spent nuclear fuel from domestic and foreign research reactors. The ROD also states that SRS non-aluminum-clad spent nuclear fuel from past production reactor operations would be shipped to INEL by the year 2035.

Since the K-Reactor is shutdown with no provision for restart, there would be no additional spent reactor fuel generated. A site-specific EIS is planned for SRS, which is expected to result in an ROD that specifies where and how spent nuclear fuel would be managed at SRS. The Pu addressed in this PEIS is limited to materials currently stored within protected vaults and gloveboxes, and additional materials within process lines and process equipment. Pu processing operations such as Pu purification, Pu recovery, oxide production, metal production, and parts fabrication have been conducted onsite, as well as receipt and large-scale storage of onsite and offsite Pu scrap and product materials. Under No Action, SRS would not be able to maintain the inventory of Pu scrap and metal in a state that provides for long-term storage while awaiting a decision for future disposition. The APSF would be constructed to meet current regulations. Maintenance, assay, packaging, and monitoring of the inventory would produce TRU, low-level, hazardous, and nonhazardous wastes. These wastes would be treated, stored, and disposed of in compliance with existing regulations.

Transuranic waste already packaged to WIPP WAC would either be stored or would have been shipped. Vitrification is planned to reduce waste shipment volume. If shipments to WIPP are delayed, or should the Department decide not to dispose of TRU waste at WIPP, additional storage facilities would be designed and constructed as needed. Mixed waste would have been incinerated, stabilized and the remaining residues disposed of onsite as LLW, according to the SRS Site Treatment Plan, which was developed to comply with the *Federal Facility Compliance Act*.

Liquid LLW would be sent to collection tanks that would be batch transferred to treatment and storage facilities onsite such as the ETF or the F-Area Tank Farm. Liquid LLW concentrate would be processed into saltstone. Solid LLW would continue to be compacted and disposed of by burial onsite in engineered trenches or vaults, depending on the LLW category. The burial ground expansion in the E-Area is expected to accommodate the current waste disposal requirements through 2024. Additional waste disposal facilities would be constructed as needed to ensure compliance. The Consolidated Incineration Facility would also be utilized to reduce the volume of LLW requiring disposal. Discussion of additional LLW disposal capacity was addressed in the *Savannah River Site Waste Management Final Environmental Impact Statement* (DOE/EIS-0217).

Savannah River Site plans to ship hazardous waste offsite for treatment and disposal in RCRA-permitted facilities. A RCRA-permitted hazardous waste storage and disposal facility is currently being designed to handle projected wastes from current operations. Specific areas are being reserved for future expansion.

Sanitary and nonhazardous process waste liquids are treated by various means to remove water and must comply with two CWA settlement agreements. Liquid sanitary waste would be piped to existing wastewater treatment facilities. The treated sanitary and process water would be discharged through NPDES outfalls and the resultant solids would be disposed of with solid nonhazardous waste in a permitted landfill sized to handle projected future waste volumes. SRS-generated municipal solid waste is currently being sent to a permitted offsite disposal facility. DOE is evaluating a proposal to participate in an interagency effort to establish a regional solid waste management center at SRS.

Upgrade Alternative

Preferred Alternative: Upgrade With Rocky Flats Environmental Technology Site Non-Pit Plutonium Subalternative

Modify Actinide Packaging and Storage Facility for Continued Plutonium Storage

Modification of the APSF to incorporate RFETS non-pit Pu would have a small impact on existing SRS waste management activities. Construction waste volumes as presented in Table E.3.1.1–8 would consist of wastewater and solid nonhazardous and hazardous waste. Nonhazardous waste would be disposed of as part of the construction project by the contractor, and the hazardous waste would be shipped offsite to commercial

RCRA-permitted treatment and disposal facilities. As shown in Table 4.2.6.10–2, the generation of TRU, mixed TRU, low-level, mixed low-level, or liquid hazardous wastes would not increase over that of No Action. The 0.56-m^3 (0.73-yd^3) increase in solid hazardous waste generation would have no impact on SRS hazardous waste management facilities. The $1,490\text{-m}^3$ (392,500-gal) increase in liquid nonhazardous waste can be accommodated in existing wastewater treatment facilities. After volume reduction, the 11 m^3 (14 yd^3) of solid nonhazardous waste such as clean non-Pu metals, packing materials, trash, defective and damaged equipment, and industrial waste from utility and maintenance operations would be shipped in accordance with site practice to a sanitary landfill with minimal impact.

[Text deleted.]

Upgrade With All or Some Rocky Flats Environmental Technology Site Plutonium and Los Alamos National Laboratory Plutonium Subalternative

Modify Actinide Packaging and Storage Facility for Continued Plutonium Storage

Modification of the APSF to incorporate RFETS and LANL material would have a small impact on existing SRS waste management activities. Construction waste volumes as presented in Table E.3.1.1–9 would consist of wastewater and solid nonhazardous and hazardous waste. Nonhazardous waste would be disposed of as part of the construction project by the contractor, and the hazardous waste would be shipped offsite to commercial RCRA-permitted treatment and disposal facilities. As shown in Table 4.2.6.10–2 the generation of TRU, mixed TRU, low-level, mixed low-level, or liquid hazardous wastes would not increase over that of No Action. The 0.8 m^3 (1 yd^3) increase in solid hazardous waste generation would have minimal impact on SRS hazardous waste management facilities. The $1,806\text{ m}^3$ (477,000 gal) increase in liquid nonhazardous waste can be accommodated in existing wastewater treatment facilities. After volume reduction, the 14 m^3 (18 yd^3) of solid nonhazardous waste such as clean non-Pu metals, packing materials, trash, defective and damaged equipment, and industrial waste from utility and maintenance operations would be shipped to a sanitary landfill with minimum impact. Distributing the RFETS and LANL material to more than one site would reduce the operational waste volumes. The decrease would be proportional to the amount of material.

Consolidation Alternative

Construct New Plutonium Storage Facility

Construction and operation of a consolidated Pu storage facility would have an impact on existing SRS waste management activities, increasing the generation of TRU, low-level, mixed, hazardous, and nonhazardous wastes. Waste generated during construction would consist of wastewater and solid nonhazardous and hazardous wastes. The nonhazardous waste would be disposed of as part of the construction project by the contractor, and the hazardous waste would be shipped to commercial RCRA-permitted treatment and disposal facilities. No soil contaminated with hazardous material or radioactive constituents is expected to be generated during construction. However, if any is generated it would be managed in accordance with site practice and all applicable Federal and State regulations. The types of operational wastes from the consolidated Pu storage facility would be the same as those from the upgrade, but the quantity would change, as shown in Table 4.2.6.10–2.

After treatment and volume reduction of TRU waste, approximately 5 m^3 (7 yd^3) of TRU waste and 4 m^3 (5 yd^3) of mixed TRU waste from leaded gloves and windows, and contaminated lead shielding would be treated and packaged to meet the current planning-basis WIPP WAC or alternative treatment level. While awaiting shipment to WIPP (depending on decisions resulting from the supplemental EIS noted earlier), the TRU waste would be stored in special purpose containers in above-grade storage facilities. One additional truck shipment per year or, if applicable, one regular train shipment every 2 years or one dedicated train shipment every 6 years would be required to transport these wastes to WIPP.

Following treatment and reduction, approximately 630 m³ (824 yd³) of LLW would be compacted and buried onsite in engineered trenches or vaults, depending on the LLW category. Assuming a land usage of 8,600 m³/ha (4,500 yd³/acre), this would require 0.07 ha/yr (0.2 acres/yr) of LLW disposal area. The 0.2 m³ (55 gal) of liquid mixed LLW and 65 m³ (85 yd³) of solid mixed LLW would be incinerated, stabilized and the remaining residues disposed of onsite as LLW, in accordance with the SRS Site Treatment Plan through the use of existing and planned facilities. The 2 m³ (476 gal) and 2 m³ (3 yd³) of solid hazardous wastes would have minimal impact on waste management activities at SRS as existing and planned facilities are adequate to handle this increase. The 168,830 m³ (44,600,000 gal) of liquid nonhazardous wastes (sanitary, utility, and process wastewater) may impact existing F-Area utility and process wastewater treatment capabilities and may require construction or expansion of utility and/or process wastewater treatment systems. The centralized sanitary wastewater treatment system is adequate to treat the sanitary portion of the liquid waste. After volume reduction, 740 m³ (968 yd³) of solid nonhazardous waste would require disposal at a permitted sanitary landfill.

Collocation Alternative

Construct New Plutonium and Highly Enriched Uranium Storage Facilities

Construction and operation of a consolidated Pu storage facility collocated with HEU storage would have an impact on existing SRS waste management activities, increasing the generation of TRU, low-level, mixed, hazardous, and nonhazardous wastes. Waste generated during construction would consist of wastewater, and solid nonhazardous and hazardous wastes. The nonhazardous waste would be disposed of as part of the construction project by the contractor and the hazardous waste would be shipped to commercial RCRA-permitted treatment and disposal facilities. No soil contaminated with hazardous material or radioactive constituents is expected to be generated during construction. However, if any is generated it would be managed in accordance with site practice and all applicable Federal and State regulations.

Because there is no TRU or mixed TRU wastes associated with HEU storage, the impacts from TRU and mixed TRU wastes are identical to those identified in the consolidated Pu storage alternative. The sources of waste are similar to those of the upgraded Pu storage facility except the source of radioactive contamination from the HEU storage is uranium.

After treatment and volume reduction, approximately 630 m³ (824 yd³) of LLW contaminated with Pu and 20 m³ (26 yd³) of LLW contaminated with uranium would be compacted and buried onsite in engineered trenches or vaults, depending on the LLW category. Assuming a land usage of 8,600 m³/ha (4,500 yd³/acre), this would require 0.08 ha/yr (0.2 acre/yr) of LLW disposal area. The 0.2 m³ (55 gal) of liquid mixed LLW and 66 m³ (86 yd³) of solid mixed LLW would be incinerated and stabilized, and the remaining residues disposed of onsite as LLW, in accordance with the SRS Site Treatment Plan through the use of existing and planned facilities. The 2 m³ (528 gal) of liquid and 2 m³ (3 yd³) of solid hazardous waste would have minimal impact on waste management activities at SRS, as existing planned facilities are adequate to handle the increase.

The 214,890 m³ (56,800,000 gal) of liquid nonhazardous waste may impact existing F-Area utility and process wastewater treatment capabilities and may require construction or expansion of utility and/or process wastewater treatment systems. The centralized sanitary wastewater treatment system is adequate to treat the sanitary portion of the liquid waste. After volume reduction, 940 m³ (1,230 yd³) of solid nonhazardous waste would require disposal at a permitted sanitary landfill.

Subalternative Not Including Strategic Reserve and Weapons Research and Development Materials

The exclusion of strategic reserve and weapons R&D materials would reduce the amount of operational waste volumes shown in Table 4.2.6.10–2 for the No Action Alternative, the Upgrade Alternative, the Consolidation

Alternative, and the Collocation Alternative. The decrease would be proportional to the amount of material excluded. [Text deleted.]

Phaseout

The phaseout of Pu storage would have a small impact on SRS waste management activities. Solid TRU waste generation would decrease by 8 m³ (11 yd³), solid LLW by 38 m³ (50 yd³), and the sanitary waste would decrease by 19,100 m³ (5,050,000 gal) for liquid and 2,290 m³ (3,000 yd³) for solid. All other waste streams would remain unchanged.

4.2.7 ROCKY FLATS ENVIRONMENTAL TECHNOLOGY SITE

A list of the proposed long-term storage alternatives, subalternatives, and related actions, including the No Action Alternative, at RFETS is provided below. The potential impacts of implementing these alternatives and related actions at RFETS are described in the following sections: land resources, site infrastructure, air quality and noise, water resources, geology and soils, biological resources, cultural and paleontological resources, socioeconomics, public and occupational health and safety, and waste management.

Preferred Alternative

Phaseout:

RFETS Pu material within the scope of this PEIS would be moved out of RFETS. Pits would be sent to Pantex and non-pit material would be sent to SRS.

Proposed Storage Activities at Rocky Flats Environmental Technology Site

- **No Action Alternative:** Continue to store RFETS Pu material within the scope of this PEIS in a new or modified facility in stabilized form pursuant to DNFSB Recommendation 94-1.
- **Upgrade Alternative:** This storage alternative does not apply to RFETS.
- **Consolidation Alternative:** This storage alternative does not apply to RFETS.
- **Collocation Alternative:** This storage alternative does not apply to RFETS.

[Text deleted.]

- **Phaseout (Preferred Alternative):** RFETS Pu material within the scope of this PEIS would be moved out of RFETS. Pits would be sent to Pantex and non-pit material would be sent to SRS.

4.2.7.1 Land Resources

No Action Alternative

Under this alternative, Pu storage would continue in a new or modified facility in stabilized form pursuant to DNFSB Recommendation 94-1. The ongoing (no new action as covered in the June 1995 EA and FONSI for the *Consolidation and Interim Storage of Special Nuclear Material at Rocky Flats Environmental Technology Site*) activities conform with present and future land-use plans, policies, and controls; therefore, no direct or indirect effects to land use or visual resources would be anticipated at RFETS beyond those of existing and future activities that are independent of the proposed action.

Preferred Alternative: Phaseout

No new construction or modification of existing facilities would occur under phaseout of the storage mission. RFETS Pu material would be moved out of RFETS to the upgrade, consolidation, or collocation sites, or to disposition. Potential impacts on visual resources could occur if facilities are not maintained.

4.2.7.2 Site Infrastructure

For selected site infrastructure parameters, Table 4.2.7.2–1 shows the site availability, projected usage under No Action, and projected usage following phaseout of the Pu storage mission. Adequate infrastructure is available to accommodate all projected site missions.

Table 4.2.7.2–1. Site Infrastructure Changes Required for Operation at Rocky Flats Environmental Technology Site (Annual)—No Action (2005) and Storage Phaseout

	Transportation		Electrical		Fuel		
	Roads (km)	Rail (km)	Energy (MWh/yr)	Peak Load (MWe)	Oil (l/yr)	Natural Gas (m ³ /yr)	Coal (t/yr)
No Action							
Site Availability	40	5	184,000	26	8,140,000	18,600,000	0
Projected usage	40	5	184,000	26	8,140,000	18,600,000	0
Amount required in excess of site availability	0	0	0	0	0	0	0
Phaseout							
Projected usage with storage phaseout	40	5	184,000	26	8,140,000	18,600,000	0
Amount required in excess of site availability	0	0	0	0	0	0	0

Source: RFETS 1995a:1.

No Action Alternative

Under No Action, RFETS would continue to consolidate surplus and strategic reserve Pu into a single interim storage facility. Processing of Pu materials is addressed in the RFETS SISMP (including solid and liquid Pu residues). The RFETS SISMP describes all near-term actions necessary to place special nuclear material into safe interim storage as well as actions designed to prepare and place the material for safe long-term storage in accordance with DNFSB Recommendation 94-1 and the *DOE Criteria for Safe Storage of Plutonium Metals and Oxides* (DOE-STD-3013-94). The RFETS SISMP is a comprehensive management plan to handle issues and vulnerabilities associated with the RFETS storage and handling of Pu and other special nuclear material and describes actions currently being implemented at RFETS.

Preferred Alternative: Phaseout

Phaseout of the Pu storage mission at RFETS would have no impact on the facilities and site infrastructure. The storage facilities would remain for D&D and/or waste management, and utility consumption would remain constant.

4.2.7.3 Air Quality and Noise

Activities associated with the No Action Alternative would generate criteria and toxic/hazardous pollutants. The Pu Storage Phaseout Alternative would result in a decrease of criteria and toxic/hazardous pollutants over the No Action Alternative. To evaluate the air quality impacts at RFETS, criteria and toxic/hazardous concentrations from the No Action Alternative are compared with Federal and State standards and guidelines. Impacts from radiological airborne emissions are described in Section 4.2.7.9.

[Text deleted.]

Emission rates attributed to site operations (No Action) are presented in Table F.1.2.8–1. Air pollutant emission sources associated with operations include the following:

- Operation of existing boilers for space heating
- Operation of diesel generators and periodic testing of emergency diesel generators
- Exhaust and road dust generated by vehicles delivering supplies and bringing employees to work
- Toxic/hazardous pollutant emissions from facility processes

Noise impacts during phaseout are expected to be low. Air quality and noise impacts for each storage alternative are described separately. Supporting data for the air quality and noise analyses are presented in Appendix F.

AIR QUALITY

An analysis was conducted of the potential air quality impacts of emissions for the storage phaseout alternative as described in Section 4.1.3.

Section 176 (c) of the 1990 CAA amendments requires that all Federal actions conform with the applicable SIP. EPA has implemented rules that establish the criteria and procedures governing the determination of conformity for all Federal actions in nonattainment and maintenance areas. These are discussed in Section 4.1.3. The attainment status of the area in which RFETS is located is discussed in Section 3.8.3. Since the area is considered a nonattainment area for O₃, PM₁₀, and CO, proposed actions at this site need to be evaluated for applicability of the conformity regulations. Total direct and indirect emissions from the No Action Alternative result in no change in emissions from RFETS. Therefore, the requirement for a conformity determination is not applicable to the No Action Alternative. Total direct and indirect emissions from Phaseout, which would include transportation emissions, have been estimated based on SST shipments of material from RFETS. These emissions are about 510 kg/yr (0.56 tons/yr) for NO₂, 56 kg/yr (0.061 tons/yr) for hydrocarbons (assumed to be VOC), and 225 kg/yr (0.25 tons/yr) for CO. These emissions are a small fraction of the total emissions from transportation emissions in the Denver area and are less than the applicability levels of 90,700 kg/yr (100 tons/yr) for VOC, NO₂, and CO for the Denver area (40 CFR 51; 40 CFR 93). Emissions of PM₁₀ consist primarily of reentrainment of road dust and emissions from diesel-powered SSTs and are expected to be a small fraction of total emissions from vehicles in the Denver area. There is expected to be minimal change in emissions from other activities related to Pu storage phaseout at RFETS. Therefore, no further analysis of conformity of phaseout at RFETS is required.

No Action Alternative

This alternative utilizes estimated air emissions data from total site operations at RFETS, assuming continuation of site missions as described in Section 3.8. These data reflect conservative estimates of criteria and toxic/hazardous emissions at RFETS. The emission rates for the criteria and toxic/hazardous pollutants for No

Action are presented in Table F.1.2.8–1. Table 3.8.3–1 presents the No Action concentrations. During dry and windy conditions, increased PM₁₀ and TSP concentrations may occur due to ongoing construction associated with other activities (that are outside of the scope of the PEIS) under the No Action Alternative. It is expected that the site will continue to comply with applicable Federal, State, and local ambient air quality standards.

Preferred Alternative: Phaseout

Phaseout of existing Pu inventories as a result of consolidating Pu at another site is expected to result in a small reduction in air pollutant concentrations from the No Action concentrations. The reduction in emissions associated with the reduction in activities at RFETS should contribute to the goal of meeting the standards for O₃, PM₁₀, and CO. Concentrations for other pollutants would be in compliance with Federal and State standards.

NOISE

The location of the fissile materials storage facilities relative to the site boundary and sensitive receptors was examined to evaluate the potential for onsite and offsite noise impacts. Traffic would occur onsite and along offsite large and regional transportation routes used to bring construction materials and workers to the site.

No Action Alternative

Nontraffic noise sources associated with continued interim storage and other ongoing missions are the same as described in Section 3.8. The continuing operations at RFETS would result in no appreciable change from current levels in traffic noise and onsite operational noise. Nontraffic noise sources are located at sufficient distance from offsite areas that the contribution to offsite noise levels would continue to be small. Due to the size of the site, noise emissions from construction equipment and operations activities would not be expected to cause annoyance to the public. Some noise sources may result in some impacts, such as disturbance of wildlife.

Preferred Alternative: Phaseout

A reduction in noise levels associated with facility operations may result from the phaseout of storage facilities.

4.2.7.4 Water Resources

Impacts associated with the No Action and phaseout of Pu storage facilities at RFETS would not affect water resources. All required water would be supplied by the City of Denver via the South Boulder Diversion Canal from the South Boulder Creek and Ralston Reservoir. Wastewater would be discharged to Walnut and Woman Creeks. Table 4.2.7.4-1 presents No Action water resources uses and discharges and the potential changes to water resources at RFETS resulting from phaseout.

Table 4.2.7.4-1. No Action and Potential Changes to Water Resources at Rocky Flats Environmental Technology Site—No Action (2005) and Storage Phaseout

Affected Resource Indicator	No Action	Phaseout
Water Source	Surface	Surface
Construction		
<i>Water Availability and Use</i>		
Total water requirements (million l/yr)	NA ^a	0
Percent increase in projected water usage ^b	NA ^a	0
<i>Water Quality</i>		
Total wastewater discharge	NA ^a	0
Percent change in wastewater discharge ^c	NA ^a	0
Operation		
<i>Water Availability and Use</i>		
Total water requirements (million l/yr)	439	0
Percent increase in projected water usage ^d	0	0
<i>Water Quality</i>		
Total wastewater discharge	130	0
Percent change in wastewater discharge ^e	0	0
Floodplain		
Is action in 100-year floodplain?	No	No
Is critical action in 500-year floodplain?	No	No

^a See operations section of table for No Action water data.

^b Percent increase in projected water usage during phaseout at RFETS is calculated by dividing No Action water requirements (439 million l/yr) with that for storage phaseout (0 l/yr).

^c Percent change in wastewater discharge during phaseout at RFETS is calculated by dividing No Action water discharges (130 million l/yr) with that for storage phaseout (0 l/yr).

^d Percent increase in projected water usage during operation at RFETS is calculated by dividing No Action water requirements (439 million l/yr) with that for storage phaseout (0 l/yr).

^e Percent change in wastewater discharge during operation at RFETS is calculated by dividing No Action water discharges (130 million l/yr) with that for storage phaseout (0 l/yr).

Note: NA= not applicable.

Source: RFETS 1995a:1.

No Action Alternative

Surface Water. [Text deleted.] A description of the activities that would continue at RFETS is provided in Section 3.8. Under this alternative, because of reduced operating requirements of existing facilities at RFETS, treated wastewater from RFETS would continue to be discharged to Walnut and Woman Creeks, and the volume would decrease from current discharge of 150 million l/yr (40 million gal/yr) to 130 million l/yr (34 million gal/yr) by the year 2005. Water requirements (439 million l/yr [116 million gal/yr]) would continue to be obtained from the city of Denver via the South Boulder Diversion Canal from the South Boulder Creek and Ralston Reservoir and are not anticipated to increase by 2005.

Groundwater. Under this alternative, no additional impacts to groundwater resources are anticipated. Water quality data obtained from monitoring wells at RFETS indicate that water quality meets or exceeds drinking water standards for a number of parameters. Under this alternative, current restoration programs would continue. Pumped, treated, and released groundwater from restoration activities is anticipated to decrease in volume from the current removal rate of 10.6 million l/yr (2.8 million gal/yr) to 7.8 million l/yr (2.1 million gal/yr) by the year 2005.

Preferred Alternative: Phaseout

Phaseout of missions at RFETS would not involve any new construction. Because existing facilities are not located in the 100- or 500-year floodplain, phaseout would not affect the floodplain area.

Surface Water. The phaseout would not result in an incremental change in the total wastewater volume handled by the plant. No impact to flow and water quality of Walnut and Woman Creeks would result. There would be no impact to water quality from phaseout activities.

Groundwater. Because RFETS does not withdraw groundwater, there would be no impact on the availability of this resource. A minor beneficial impact on groundwater resources would occur due to the lessened potential for degradation of water quality. Spill protection systems and plans exist to contain and minimize effects of releases of hazardous substances during phaseout activities. Given normal safeguards and procedures, no impact to groundwater quality would be expected to result from activities associated with the phaseout of Pu storage functions at RFETS. Current restoration activities would continue under this alternative.

4.2.7.5 Geology and Soils

RFETS is considered only for the No Action Alternative and under storage phaseout. As discussed below, neither of these activities involves new construction and would therefore have no effect on the geologic and soil resources at the site. Impacts to geologic and soil resources occur during, or as a result of, ground-disturbing activities.

No Action Alternative

Under the No Action Alternative, DOE would continue current and ongoing activities at RFETS. There would be no new ground-disturbing activities beyond those already associated with existing and future site improvements. Because no new construction (associated with this program) or associated ground disturbance for potential soil erosion would occur, the No Action Alternative would have no effect on geologic or soil resources at the site.

Preferred Alternative: Phaseout

The phaseout of storage capacity would have no apparent effects on the geology. However, phaseout could result in beneficial effects on the soils of the area. Hazardous, radioactive, and mixed waste sources would be eliminated from the area, thus decreasing the potential for future soil contamination.

4.2.7.6 Biological Resources**No Action Alternative**

The Pu storage mission described in Section 2.2.7 would continue at RFETS. This would result in no appreciable change in current conditions of biological resources at RFETS as described in Section 3.8.6.

| Preferred Alternative: Phaseout

Pu materials at RFETS would be phased out of operation. The phaseout of Pu storage facilities is not expected to affect biological resources, although increased human activity could, as a result of phaseout activities, temporarily disturb some wildlife species in the vicinity of the site.

4.2.7.7 Cultural and Paleontological Resources

No Action Alternative

Under this alternative, DOE would continue the existing and planned missions at RFETS, including the continued storage of Pu material in a new facility in stabilized form pursuant to DNFSB Recommendation 94-1. Any impacts to cultural or paleontological resources from these missions would be independent of the proposed action and would be addressed through separate NHPA, *American Indian Religious Freedom Act*, and *Native American Graves Protection and Repatriation Act* regulatory compliance procedures. A cultural resources management plan is in preparation for RFETS.

| Preferred Alternative: Phaseout

For this alternative, all Pu materials at RFETS within the scope of this PEIS would be transferred to another site and the storage mission would be phased out. Impacts to prehistoric resources are not anticipated because phaseout is not expected to result in ground-breaking activity. Likewise, no impacts to paleontological remains are expected. It may affect, through alteration, if subsequently proposed, some of the 65 historic structures at RFETS that have been identified as NRHP-eligible. DOE has recently begun efforts to identify Native American groups with ties to the land at RFETS, however, phaseout is not expected to affect important Native American resources.

4.2.7.8 Socioeconomics

No Action Alternative

Regional Economy Characteristics. Total employment in the REA is projected to increase approximately 2 percent annually between 1995 and 2000, reaching 1,985,400 in the latter year. Long-range projections indicate slower growth after the year 2000, when employment would increase about 1 percent annually and reach approximately 2,970,500 persons in 2040. Unemployment in the REA was 4.1 percent in 1994 and is expected to remain at this level into the near future. Per capita income is projected to increase from approximately \$22,721 in 1995 to \$37,025 in 2040. Projections for the No Action Alternative are presented in Table L.1-64.

Population and Housing. Population in the ROI is projected to increase from approximately 1,991,700 in 1995 to 3,245,300 by 2040. The total number of housing units in the ROI is projected to increase from about 855,200 in 1995 to 1,371,600 in 2040. Population and housing projections for the No Action Alternative are presented in Tables L.1-65 and L.1-66, respectively.

Community Services. Education, public safety, and health care characteristics are used to assess the level of community services in the RFETS ROI. School enrollments are projected to increase from about 336,840 students in 1995 to 562,320 students by 2040. The current student-to-teacher ratio is 19.0:1. To maintain this level of service, the number of teachers in the ROI would need to increase from approximately 17,751 in 1995 to 29,417 in 2040. These projections are presented in Tables L.1-67 and L.1-68.

The projected numbers of sworn police officers and firefighters serving in ROI communities over the period 1995 to 2040 are shown in Tables L.1-69 and L.1-70, respectively. Under No Action the number of sworn police officers is projected to increase from approximately 3,871 in 1995 to 6,036 in 2040 to maintain the current service level of 2.0 sworn officers per 1,000 persons. The number of firefighters in the ROI would need to increase from about 5,408 in 1995 to 9,118 in 2040 to maintain the present service level of 2.7 firefighters per 1,000 persons.

Hospital occupancy rates are based on current capacity. These rates and the estimated number of physicians serving the ROI population between 1995 and 2040 are presented in Tables L.1-71 and L.1-72, respectively. Hospital occupancy rates are projected to increase from approximately 56 percent in 1995 to 91 percent in 2040. To maintain the current service level of 2.6 physicians per 1,000 persons, the total number of physicians in the ROI would need to increase from approximately 5,085 in 1995 to 7,387 in 2040.

Local Transportation. Any increases in traffic would be due to projected growth in the area unrelated to DOE activities. The only alternative considered at RFETS is phaseout, which involves decreasing employment, and, therefore, decreasing traffic. Since there would be no impacts, modeling was not done.

Preferred Alternative: Phaseout

Phasing out Pu storage at RFETS would result in the loss of 10,051 (2,129 direct and 7,922 indirect) jobs in the REA, which would be considered a potential impact. Should all personnel be phased out at the same time, unemployment would increase to 4.6 percent and per capita income would be reduced by less than 1 percent (Socio 1996a).

Some displaced workers may out-migrate from the ROI to seek other employment opportunities. Under the bounding case (all unemployed workers and their families leaving the ROI at the same time), population would decrease by about 1 percent. Some of the projected ROI occupied housing units would become vacant as a result of population losses (Socio 1996a).

The out-migration of population during phaseout would slightly lessen the demand for community services. It is unlikely that communities would lower service levels unless decreased revenues made it necessary.

School enrollments in the ROI could decrease by about 1 percent under the bounding-case scenario for phaseout. The No Action student-to-teacher ratio of 19.0:1 could be maintained if the number of teachers does not decrease from predicted No Action levels by more than 193 (Socio 1996a).

During phaseout, the number of sworn police officers could decrease by as many as 35 officers from projected No Action levels before the No Action service level of 2.0 officers per 1,000 persons would not be maintained. Additionally, the number of firefighters could decrease by as much as 50 before the No Action service level of 2.7 firefighters per 1,000 persons would be affected (Socio 1996a).

Projected hospital occupancy rates under the bounding-case scenario for phaseout would be slightly lower than the No Action projections. The number of physicians in the ROI could decrease by up to 43 from predicted No Action levels before the No Action service level of 2.6 physicians per 1,000 persons would be affected (Socio 1996a).

If the phaseout of Pu storage at RFETS led to a reduction of the ROI population, traffic conditions should improve over the No Action baseline.

4.2.7.9 Public and Occupational Health and Safety

Assessments have been made of potential radiological and chemical impacts associated with the No Action Alternative at RFETS. A discussion of reduced impacts associated with the phaseout of existing Pu storage is also presented. Summaries of radiological impacts from normal operations are presented in Tables 4.2.7.9-1 and 4.2.7.9-2 for the public and workers, respectively. Impacts from hazardous chemicals are presented in Table 4.2.7.9-3. Impacts associated with postulated accidents are addressed in this section.

No Action Alternative

This section describes the radiological and hazardous chemical releases and their associated impacts resulting from either normal operation or accidents involved with the current sitewide mission including interim storage of Pu at RFETS. The section describes the impacts from normal operation, then describes the potential risks of impacts from facility accidents.

The impacts on the public and on workers under the No Action Alternative during normal operation at RFETS would be within applicable regulatory limits.

Normal Operation. The current mission at RFETS, where Pu is in interim storage, is described in Section 3.8. The site has identified those facilities that will continue to operate under the No Action Alternative, including interim Pu storage facilities. Radiological and chemical impacts on the public and workers at RFETS are described below.

Radiological Impacts. The calculated annual dose to the average and maximally exposed members of the public, the associated fatal cancer risks to these individuals from 50 years of total site operation, the dose to the population within 80 km (50 mi) from total site operation in the year 2030, and the projected number of fatal cancers in this population from 50 years of operation are presented in Table 4.2.7.9-1 under this alternative at RFETS. The annual dose of 0.48 mrem to the MEI is within the radiological limits specified in NESHAPS (40 CFR 61, Subpart H) and DOE Order 5400.5. The annual dose of 0.10 person-rem to the population is within the proposed reporting limit. To put operational dose impacts into perspective, comparisons with doses from natural background radiation are included in the table.

The average annual dose to a site worker and the associated risk of fatal cancer from 50 years of total site operations, and the annual dose to the total site workforce and the projected number of fatal cancers from 50 years of total site operations, are presented in Table 4.2.7.9-2 for the No Action Alternative at RFETS.

Hazardous Chemical Impacts. Hazardous chemical impacts on the public resulting from the normal operation under No Action at RFETS are presented in Table 4.2.7.9-3. The noncancerous health effects expected and the risk of cancer due to the total chemical exposures, must be estimated for each site. Since the major releases due to normal operation at RFETS would make up nearly all of the exposures to onsite workers and to the public in adjacent communities, contributions to the hazardous chemical concentrations from all other sources, for example, industrial operations, are considered negligible for purposes of risk calculations.

The HI for the MEI of the public at RFETS resulting from normal operation under the No Action Alternative is 1.2×10^{-3} , and the cancer risk is 2.1×10^{-8} . The HI to the onsite worker is 1.3×10^{-2} , and the cancer risk is 2.3×10^{-6} .

Table 4.2.7.9–1. Potential Radiological Impacts to the Public During Normal Operation at Rocky Flats Environmental Technology Site—No Action

Receptor	No Action
Annual Dose to the Maximally Exposed Individual Member of the Public^a	
Atmospheric release pathway (mrem)	0.13
Drinking water pathway (mrem)	0.35
Total liquid release pathway (mrem)	0.35
Atmospheric and liquid release pathways combined (mrem)	0.48
Percent of natural background ^b	0.14
50-year fatal cancer risk	1.2×10^{-5}
Population Dose Within 80 Kilometers for Year 2030^c	
Atmospheric release pathways (person-rem)	0.10
Total liquid release pathways (person-rem)	0
Atmospheric and liquid release pathway combined (person-rem)	0.10
Percent of natural background ^b	9.1×10^{-6}
50-year fatal cancers	2.5×10^{-3}
Annual Dose to the Average Individual Within 80 Kilometers^d	
Atmospheric and liquid release pathways combined (mrem)	3.2×10^{-5}
50-year fatal cancer risk	8.0×10^{-10}

^a The applicable radiological limits for an individual member of the public from site operations are 10 mrem per year from the air pathways, as required by NESHAPS (40 CFR 61, Subpart H) under the CAA; 4 mrem per year from the drinking water pathway as required by the SDWA; and 100 mrem per year from all pathway combined. Refer to DOE Order 5400.5.

^b The annual natural background radiation level at RFETS is 353 mrem for the average individual; the population within 80 km in the year 2030 receives 1.1×10^6 person-rem.

^c For DOE activities, proposed 10 CFR 834 (see 58 FR 16268) would generally limit the potential annual population dose to 100 person-rem from all pathways combined, and would require an ALARA program.

[Text deleted.]

^d Obtained by dividing the population dose by the number of people projected to live within 80 km of the site in 2030 (3,116,000).

Note: It is assumed that these doses will not be exceeded in the future since no additional activities are planned at the RFETS under the No Action Alternative.

Source: RFETS 1994a.

Table 4.2.7.9-2. Potential Radiological Impacts to Workers During Normal Operation at Rocky Flats Environmental Technology Site—No Action

Receptor	No Action
Involved Workforce^a	
Average worker dose (mrem/yr) ^b	250
50-year risk of fatal cancer	5.0×10^{-3}
Total dose (person-rem/yr)	25
50-year fatal cancers	0.50
Noninvolved Workforce^c	
Average worker dose (mrem/yr) ^b	122
50-year risk of fatal cancer	2.4×10^{-3}
Total dose (person-rem/yr)	775
50-year fatal cancers	15
Total Site Workforce^d	
Dose (person-rem/yr)	800
50-year fatal cancers	16

^a The involved worker is a worker associated with operations of interim Pu storage. It is assumed that there are 100 workers, badged with dosimeters to monitor radiation exposure, with a conservatively estimated average dose of 250 mrem/yr per worker. However, an effective ALARA program will ensure that the exposure will be reduced to that level which is as low as reasonably achievable.

^b The radiological limit for an individual worker is 5,000 mrem/year (10 CFR 835). However, DOE has also established an administrative control level of 2,000 mrem/yr (DOE1992t); the site must make reasonable attempts to maintain doses below this level.

^c The noninvolved worker is a worker onsite but not associated with interim Pu storage operations. The projected number of noninvolved badged workers in 2005 is 6,350.

^d The impact to the total workforce is the summation of the involved worker impact and the noninvolved worker impact.

[Text deleted.]

Source: DOE 1993n:7.

Table 4.2.7.9-3. Potential Hazardous Chemical Impacts to the Public and Workers During Normal Operation at Rocky Flats Environmental Technology Site—No Action

Receptor	Total Site ^a
Maximally Exposed Individual (Public)	
Hazard Index ^b	1.2×10^{-3}
Cancer risk ^c	2.1×10^{-8}
Worker Onsite	
Hazard Index ^d	1.3×10^{-2}
Cancer risk ^e	2.3×10^{-6}

^a Total=The No Action contributions.

^b Hazard Index for MEI: sum of individual Hazard Quotients (noncancerous health effects) for MEI.

^c Cancer risk for MEI=(emissions for 8-hr) x (0.286 [converts concentrations to doses]) x (slope factor [SF]).

^d Hazard Index for workers: sum of individual Hazard Quotients (noncancerous health effects) for workers.

^e Cancer risk for workers=(emissions for 8-hr) x (0.286 [converts concentrations to doses]) x (0.237[fraction of year exposed]) x (0.571 [fraction of lifetime working]) x (SF).

Source: Section M.3, Table M.3.4-26.

Facility Accidents. Under the No Action Alternative, Pu would continue to be stored at the site in existing facilities. These facilities currently operate in accordance with DOE Orders which ensure that the risk to the public of prompt fatalities due to accidents or cancer fatalities due to operations will be in accordance with the DOE safety goals. The safety to workers and the public from accidents at existing facilities is also controlled by technical safety requirements specified in detail in a SAR or Basis for Interim Operations document prepared and maintained specifically for a facility or process within a facility. Under these controls, any change in approved operations or to facilities would cause a halt in operations until it can be established that worker and public safety has not been compromised.

Preferred Alternative: Phaseout

Normal Operation. The phaseout of Pu storage at RFETS would reduce the impacts from radiological and chemical releases and exposures to levels below the No Action levels. All workers involved in the removal of Pu from RFETS would be monitored to ensure that their doses remain within acceptable levels.

Facility Accidents. The phaseout operation will be conducted in accordance with DOE Orders to ensure that the risk to the public of prompt fatalities due to accidents or of cancer fatalities due to operations will be minimized. For current operations in the facility that would be phased out, the safety of workers and the public from accidents is controlled by Technical Safety Requirements that are specified in SARs or Basis for Interim Operations documents that have been prepared for the facility. Prior to initiating phaseout, the potential for accidents that could impact workers and the public will be assessed and, if necessary, applicable existing safety documentation will be modified to ensure safety for workers and the public.

4.2.7.10 Waste Management

This section summarizes the impacts on waste management at RFETS under No Action and the phaseout of Pu storage. There is no spent nuclear fuel or HLW associated with Pu storage. Table 4.2.7.10–1 lists the projected waste generation rates and treatment, storage, and disposal capacities under No Action for 2005. Projections for No Action were derived from the most recent available environmental data, with the appropriate adjustments made for those changing operational requirements where the volume of wastes generated are identifiable. The projection does not include wastes from future, yet uncharacterized, environmental restoration activities. The projections for No Action could change depending on decisions resulting from the Waste Management PEIS. Facilities that would support the storage of Pu would treat and package all waste generated into forms that would enable staging and/or disposal in accordance with RCRA and other relevant statutes. Depending in part on decisions in waste-type-specific RODs for the Waste Management PEIS, wastes could be treated and disposed of onsite or at regionalized and centralized DOE sites. For the purpose of analyses only, this PEIS assumes that TRU and mixed TRU waste would be treated onsite to the current planning-basis WIPP WAC, and shipped to WIPP for disposal. This PEIS also assumes that LLW, mixed LLW, hazardous, and nonhazardous waste would be treated and disposed of in accordance with current site practice.

No Action Alternative

Under No Action, TRU, low-level, mixed residues, hazardous, and nonhazardous waste would continue to be managed at RFETS from the missions described in Section 3.8. Waste management activities at RFETS are categorized as regulatory compliance and project administration, waste minimization, waste treatment, waste storage, and waste disposal. Within each category of waste management activity, various wastes are handled according to waste type as defined by various DOE orders, as well as Federal and State regulations. Applicable permitting, treatment, storage, and disposal requirements are determined according to these waste types. Under No Action, RFETS would continue to store quantities of Pu in various forms. This storage would generate small quantities of TRU, low-level, hazardous, mixed, and nonhazardous wastes. The primary focus for waste management at RFETS would be the continued processing of existing wastes, transition of facilities, and environmental restoration. It is anticipated that the Pu storage mission would have minimal impact on the waste management program at RFETS. The plant has stored Pu since 1956 and is adequately equipped to manage the wastes from the storage mission using the existing waste management infrastructure. Waste generated by cleanup activities is expected to be much greater than wastes generated from continued storage of Pu. The impacts of the wastes generated as part of environmental restoration and D&D activities would be addressed in individual remedial action feasibility studies. The Rocky Flats Cleanup Agreement provides the legal enforcement framework for assessing the nature and extent of contamination, determining the risks imposed by that contamination to workers, the public, and the environment; and implementing actions designed to remediate the contamination.

Transuranic waste would be treated and packaged to meet the current planning-basis WIPP WAC or alternative treatment level and then stored in one of the RCRA-permitted storage units pending approval of WIPP as a repository for these wastes. Assuming WIPP is determined to be a suitable repository for these wastes, pursuant to the requirements of 40 CFR 191 and 40 CFR 268, these wastes would be packaged in accordance with DOE and DOT requirements for transport to WIPP depending on decisions made in the ROD associated with the Supplemental EIS being prepared for the proposed continued phased development of WIPP for disposal of TRU wastes.

Low-level waste would be compacted whenever possible, packaged to meet the WAC of the NTS low-level disposal facility, and then shipped to NTS for disposal. Mixed LLW would be treated and disposed in accordance with the *RFETS Treatment Plan* that was developed to comply with the *Federal Facility Compliance Act*. Hazardous wastes would be collected and packaged in DOT-approved containers for shipment to offsite RCRA-permitted commercial treatment, storage, and disposal facilities. Solid nonhazardous wastes would be disposed in the onsite permitted landfill.

Table 4.2.7.10-1. Projected Waste Management Under No Action (2005) at Rocky Flats Environmental Technology Site

Category	Annual Generation (m ³)	Treatment Method	Treatment Capacity (m ³ /yr)	Storage Method	Storage Capacity (m ³) ^a	Disposal Method	Disposal Capacity (m ³)
Transuranic							
Liquid	<1	Solidification	149,000 ^b	None	None	NA	NA
Solid	1,583	Compaction	4,630 ^c	Drums on pads	6,220 ^d	WIPP or alternate facility	NA
Mixed Transuranic							
Liquid	<1	Solidification	Included in TRU liquid	None	None	NA	NA
Solid	1,505	Compaction	Included in TRU solid	Drums on pads	Included in solid TRU	WIPP or alternate facility	NA
Low-Level							
Liquid	<1	Evaporation and solidification	Included in liquid mixed LLW	Staged	105 ^e	NA	NA
Solid	701	None	5,600 ^f	Staged	4,540 ^e	Offsite	NA
Mixed Low-Level							
Liquid	None ^g	Solidification	47,500 ^h	Staged for treatment	Included in solid mixed LLW	NA	NA
Solid	6,019	None	7,100 ⁱ	DOT containers	17,700 ^j	Offsite	NA
Hazardous							
Liquid	<1	Neutralization & precipitation	None	Staged in DOT containers	Included in solid hazardous	Offsite	NA
Solid	25	None	None	Staged in DOT containers	260 ^k	Offsite	NA
Hazardous (Residues)							
Liquid	None	None	None	Staged only	Included in liquid hazardous	Offsite	NA
Solid	None	None	None	Staged only	Included in liquid hazardous	Offsite	NA
Nonhazardous (Sanitary)							
Liquid	457,600 ^l	Sedimentation	565,000	None	None	Surface water	NA
Solid	11,400	None	None	None	None	Onsite landfill	Expandable ^m

Table 4.2.7.10-1. Projected Waste Management Under No Action (2005) at Rocky Flats Environmental Technology Site—Continued

Category	Annual Generation (m ³)	Treatment Method	Treatment Capacity (m ³ /yr)	Storage Method	Storage Capacity (m ³) ^a	Disposal Method	Disposal Capacity (m ³)
Nonhazardous (Other)							
Liquid	Included in sanitary	Sedimentation	Included in sanitary	None	None	Surface water	NA
Solid	73	None	None	None	None	Onsite landfill	Expandable ¹
^a Additional storage capacity requirements depend upon the existing storage requirements, existing storage capacity, and existing permit conditions.							
^b Value taken from Draft Waste Management PEIS and includes Process Waste Treatment Facility and Organic and Sludge Immobilization System.							
^c Value taken from Draft Waste Management PEIS and includes Supercompaction and Repackaging Facility, Advance Size Reduction Facility, and Size Reduction Vault.							
^d Value taken from Draft Waste Management PEIS and includes the current TRU inventory and the projected 20-year generation.							
^e Cumulative volume of LLW stored at end of 1993 as per a Memorandum from McGlochin, EG&G to Reece, DOE on updated information for Nonnuclear Consolidation EA.							
^f Value taken from Draft Waste Management PEIS and reflects compaction activities.							
^g No waste in this category is expected to be generated in 2005. Treatment, storage, and disposal are expected to continue for waste generated from past activities.							
^h Based on the operating capacities of Building 374 and 774 as described in the 1995 Mixed Waste Inventory Report.							
ⁱ Based on the operating capacities of Building 776 as described in the 1995 Mixed Waste Inventory Report. Value calculated using the conversion ratio of 1,500 kg/m ³ .							
^j Value taken from Draft Waste Management PEIS and reflects Mixed Waste container storage activities.							
^k Value based on the 1991 Waste Storage Inventory Report and the Memorandum from McGlochin, EG&G to Reece, DOE on updated information for Nonnuclear Consolidation EA.							
^l Value taken from 1993 <i>RFETS Site Environmental Report</i> and reflects Annual Discharge from main collection pond (Pond A-4).							
^m Landfill will provide additional 20 years of capacity.							
Note: NA=not applicable.							
Source: DOE 1995cc; DOE 1995gg; RF EG&G 1992e; RFETS 1994a; RFETS 1995a:1; RFP 1993a:1; RFP 1993a:2.							

| **Preferred Alternative**

Phaseout

- | [Text deleted.] The small amount of waste associated with Pu storage would no longer be generated, but the total wastes generated at RFETS could increase as a result of the cleanup activities of facilities formerly used for Pu storage.

4.2.8 LOS ALAMOS NATIONAL LABORATORY

A list of the proposed long-term storage alternatives, subalternatives, and related actions, including the No Action Alternative, at LANL is provided below. The potential impacts of implementing these alternatives and related actions at LANL are described in the following sections: land resources, site infrastructure, air quality and noise, water resources, geology and soils, biological resources, cultural and paleontological resources, socioeconomics, public and occupational health and safety, and waste management.

Preferred Alternative

No Action Alternative:

Continue to store LANL Pu material in the modified NMSF in stabilized form pursuant to DNFSB Recommendation 94-1.

Proposed Storage Activities at Los Alamos National Laboratory

- **No Action Alternative (Preferred Alternative):** Continue to store LANL Pu material in the modified NMSF in stabilized form pursuant to DNFSB Recommendation 94-1.
- **Upgrade Alternative:** This storage alternative does not apply to LANL.
- **Consolidation Alternative:** This storage alternative does not apply to LANL.
- **Collocation Alternative:** This storage alternative does not apply to LANL.
- **Subalternative Not Including Strategic Reserve and Weapons Research and Development Materials:** This storage subalternative does not apply to LANL.
- **Phaseout:** LANL Pu material would be moved out of LANL to the upgrade, consolidation, or collocation sites (located at another DOE site) or to disposition (for surplus Pu).

4.2.8.1 Land Resources

Preferred Alternative: No Action Alternative

Under this alternative, LANL would continue to store Pu material in the upgraded NMSF in stabilized form pursuant to DNFSB Recommendation 94-1. The ongoing (no new action) activities conform with present and future land-use plans, policies, and controls; therefore, no direct or indirect impacts to land resources would be anticipated beyond those of existing and future activities that are independent of the proposed action.

Phaseout

No new construction or upgrade of existing facilities would occur under the phaseout of the Pu mission at LANL. Pu material would be moved out of LANL to the upgrade, consolidation or collocation sites, or to disposition. Potential impacts on visual resources could occur if facilities are not maintained.

4.2.8.2 Site Infrastructure

For selected site infrastructure parameters, Table 4.2.8.2-1 shows the site availability, projected usage under No Action, and projected usage following phaseout of surplus Pu storage at LANL. Adequate infrastructure is available to accommodate all projected site missions.

Table 4.2.8.2-1. Site Infrastructure Changes Required for Operation at Los Alamos National Laboratory (Annual)—No Action (2005) and Storage Phaseout

	Transportation		Electrical		Fuel		
	Roads (km)	Rail (km)	Energy (MWh/yr)	Peak Load (MWe)	Oil (l/yr)	Natural Gas (m ³ /yr)	Coal (t/yr)
No Action							
Site Availability	137	0	500,000	100	0	103,368,000	0
Projected usage	137	0	381,425	87	0	43,414,560	0
Amount required in excess of site availability	0	0	0	0	0	0	0
Phaseout							
Projected usage with storage phaseout	137	0	381,425	87	0	43,414,560	0
Amount required in excess of site availability	0	0	0	0	0	0	0

Source: LANL 1995b:1.

Preferred Alternative: No Action Alternative

Under No Action, weapons-usable Pu materials would be stabilized pursuant to DNFSB Recommendation 94-1, with all identified Pu ES&H vulnerabilities addressed in accordance with LANL's proposed *Corrective Action Plan*. Consistent with this plan, Pu materials not required for operational use would be stored in the renovated NMSF.

Phaseout

Phaseout of the Pu storage mission at LANL would have no impact on the existing facilities and site infrastructure. The storage facilities would remain for operational use, and utility consumption would remain constant.